Repairs to Evans Gym Pools

Solicitation #10-23

PROJECT MANUAL

January 12, 2010

Set No. ________

Construction Manager

EASTERN PCM, LLC

645 N. 12th Street
Suite 200
Lemoyne, PA 17043
Phone: (717) 233-3816
Fax: (717) 233-1666

Engineer

JMT

200 St. Charles Way
Suite 200
York, PA 17402
Phone: (717) 741-1600
Fax: (717) 741-9100
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REPAIRS TO EVANS GYM POOLS
Solicitation #10-23

Engineer
Johnson, Mirmiran, Thompson
200 St. Charles Way, Suite 200
York, PA 17402
Phone: (717) 741-1600

Construction Manager
Eastern pcm, LLC
645 N. 12th Street, Suite 200
Lemoyne, PA 17043
Phone: (717) 233-3816

HACC, Central Pennsylvania’s Community College seeks bids from qualified Prime Contract Bidders to construct the above named project. The project is located at the Evans Gymnasium, HACC Harrisburg Campus, One HACC Drive, Harrisburg, PA, 17110. HACC is committed to providing opportunities for Minority Business Enterprises (MBE), and Women Business Enterprises (WBE). HACC encourages MBE and WBE firms to submit a Proposal for the Work and all bidders to proactively solicit MBE and WBE firms in the bidding and subcontracting process.

The work will be performed under a Single Prime Contract and consists of removal and replacement of the ceramic tile in the training pool, diving tank, and the pool decks; ramp and railing modifications for ADA compliance; modifications to the pool drain systems for compliance with the Virginia Graeme Baker Act; installation of a new vacuum system in the training pool and diving tank; removal and replacement of the rooftop mounted Desert Aire HVAC system, including all electric, plumbing, roofing, and controls for a complete installation; modifications to the existing balance tank and installation of an automated pool water level management system, including the removal of the existing fill tank and associated piping. Electrical work will include, but not be limited to, installation of new circuitry for the rooftop mounted HVAC systems, installation of new electrical panels and branch circuitry.

A Pre-Bid Meeting and site inspection will be held January 19, 2010 at 1:00pm at The Evans Gymnasium at the Harrisburg Campus. All bidders are encouraged to attend.

HACC will receive sealed bids for the work at the HACC Harrisburg Campus, One HACC Drive, Harrisburg, PA - Purchasing Office, Room 130, Whitaker Hall until 3:00pm on February 4, 2010. Bids received after this time will not be accepted. ONLY BONAFIDE BIDS WILL BE ACCEPTED. Bids will be opened and read aloud immediately following the bid receipt time.

Plans and specifications, prepared by Johnson, Mirmiran, Thompson, may be examined during normal office hours at the office of the Construction Manager, and at the Mid-Atlantic BX located at 2501 North Front St., Harrisburg, PA 17110.

Bid documents in .pdf electronic format may be purchased from the office of the Construction Manager for a non-refundable fee of $25.00. Shipping costs are not included in this fee. The bidder will be responsible for all shipping costs if necessary.
HACC, the Engineer, and the Construction Manager assume no responsibility for the completeness and accuracy of plans and specifications and addenda issued that were not acquired from the office of the Construction Manager.

Bid Security in the amount of 10% of the Bid amount must accompany the Bid in accordance with the Instruction to Bidders.

A Performance and Payment Bond for 100% of the contract amount will be required in accordance with the Instructions to Bidders.

The referenced project is subject to the Pennsylvania Department of Labor and Industry Prevailing Wage Rates.

The Owner, HACC, Central Pennsylvania’s Community College, reserves the right to waive any irregularities, omissions, errors, mistakes, or defects in any bid or to reject any or all bids at their sole discretion.

By order of:

Thomas J. Fogarty  
Executive Director, Business and Auxiliary Services  
HACC, Central Pennsylvania’s Community College  
One HACC Drive,  
Harrisburg, PA 17110

END OF SECTION 00100
SECTION 00150 – INFORMATION FOR BIDDERS

1. SCOPE OF WORK

The work will be performed under a Single Prime Contract and consists of removal and replacement of the ceramic tile in the training pool, diving tank, and the pool decks; ramp and railing modifications for ADA compliance; modifications to the pool drain systems for compliance with the Virginia Graeme Baker Act; installation of a new vacuum system in the training pool and diving tank; removal and replacement of the rooftop mounted Desert Aire HVAC system, including all electric, plumbing, roofing, and controls for a complete installation; modifications to the existing balance tank and installation of an automated pool water level management system, including the removal of the existing fill tank and associated piping. Electrical work will include, but not be limited to, installation of new circuitry for the rooftop mounted HVAC systems, installation of new electrical panels and branch circuitry.

2. SECURING DOCUMENTS

Plans and specifications prepared by Johnson, Mirmiran, Thompson may be examined during normal office hours, at the office of the Construction Manager, and at the Mid-Atlantic BX located at 2501 North Front St., Harrisburg, PA 17110.

Copies of the bid documents may be obtained from the office of the Construction Manager: Eastern pcm, LLC upon the conditions set forth in the Invitation to Bid.

3. EXAMINATION OF DOCUMENTS, PRE BID MEETING AND SITE VISITS

A. Before submitting a bid, each bidder shall examine the Drawings carefully, shall read the Specifications and all other proposed Contract Documents and shall visit the site of the Work. Each bidder shall fully inform himself prior to bidding as to existing conditions and limitations under which the Work is to be performed and shall include in his bid a sum to cover the cost of items necessary to perform the work as set forth in the proposed Contract Documents. No allowance will be made to a bidder because of lack of such examination or knowledge. The submission of a bid will be considered as conclusive evidence that the bidder has made such examination.

HACC, The Engineer, and the Construction Manager assume no responsibility for the completeness and accuracy of plans and specifications and addenda issued that were not acquired from the office of the Construction Manager.

B. PRE BID MEETING: A Pre-Bid Meeting and site inspection will be held at the Evans Gymnasium at the Harrisburg Campus on January 19, 2010 at 1:00pm All bidders are encouraged to attend.
C. Site visits may be arranged by contacting the Construction Manager, Eastern pcm, LLC; Attn: Mark McCammon, 717-233-3816

4. CODE COMPLIANCE

Contractor's bid is to be in compliance with all local and applicable codes. Contract price to be based upon compliance with all codes.

5. COMPLETION SCHEDULE & WORK HOURS

A. SCHEDULE

i. Contract Award: March 3, 2010

ii. Notice to Proceed: May 15, 2010

iii. Substantial Completion Date: August 13, 2010

B. WORKING HOURS

i. All work is to be performed between 7:00am and 5:00pm. Work performed outside of these hours requires approval of the Owner and Construction Manager.

ii. Utility shutdown and switchover work is to be conducted when the campus is not occupied. Coordinate with the Construction Manager and HACC Facilities.

6. TEMPORARY PROTECTION

The Base Bid Scope of Work includes providing, erecting, maintaining and removing temporary walls, partitions, entrances and coverings as required to facilitate the phased demolition and construction as shown on the drawings.

END OF SECTION 00150
SECTION 00200 – INSTRUCTIONS TO BIDDERS AIA DOCUMENT A701-1997

The attached AIA Document A701 – 1997 shall be the contract format for the project.

END OF SECTION 00200
Instructions to Bidders

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

Sample

THE OWNER:
(Name and address):

THE ARCHITECT:
(Name and address):

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

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.
ARTICLE 1 DEFINITIONS
§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

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

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

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

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS
§ 2.1 The Bidder by making a Bid represents that:
§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS
§ 3.1 COPIES
§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.
§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

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

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

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

§ 3.3 SUBSTITUTIONS

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

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect’s decision of approval or disapproval of a proposed substitution shall be final.

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

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

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

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

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.
ARTICLE 4  BIDDING PROCEDURES
§ 4.1 PREPARATION OF BIDS
§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

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

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

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

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder’s refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of the legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent’s authority to bind the Bidder.

§ 4.2 BID SECURITY
§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

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

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

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

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID
§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.
§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS
§ 5.1 OPENING OF BIDS
At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS
The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)
§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner’s judgment, is in the Owner’s own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION
§ 6.1 CONTRACTOR’S QUALIFICATION STATEMENT
Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor’s Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.2 OWNER’S FINANCIAL CAPABILITY
The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner’s obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 SUBMITTALS
§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

- .1 a designation of the Work to be performed with the Bidder’s own forces;
- .2 names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

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§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder’s option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND
§ 7.1 BOND REQUIREMENTS
§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder’s usual sources.

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

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder’s usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS
§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

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

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

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR
Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.
SECTION 00210 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

To be considered, Bids must be made in accordance with the Instructions to Bidders (AIA Document A701), the General Conditions to the Contract, (AIA Document A201/CMa) and the supplements thereto.

The following supplementary Instructions to Bidders modify, change, delete from, or add to the Instructions to Bidders. When any Article of the Instructions to Bidders is modified or deleted by these supplements, the unaltered provisions of that article, paragraph, subparagraph, or clause shall remain in effect as part of the Bidding Requirements.

ARTICLE 1 – DEFINITIONS

Add the following paragraph:

1.10 A Successful Bidder is the lowest, responsible and responsive Bidder to whom Owner (on the basis of Owner’s evaluation) makes an award.

ARTICLE 3 - BIDDING DOCUMENTS

3.1 COPIES

3.1.1 Delete this paragraph in its entirety and replace with the following:

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office(s) stated in the Invitation to Bid in the amount of the non-refundable fee stated therein.

3.1.2 Delete this paragraph in its entirety.

Add the following subparagraph

3.1.5 HACC, the Engineer, and the Construction Manager assume no responsibility for the completeness and accuracy of plans and specifications and addenda issued that were not acquired from the office of the Construction Manager.

3.3 SUBSTITUTIONS

3.3.2 Delete this paragraph in its entirety and replace with the following:

3.3.2 Approval of substitutions will not be given during the period provided for the preparation and receipt of bids. The Owner shall consider the use of substitutions, at their sole discretion, only after the award of the Contracts.

3.3.2.1 Add the following new subparagraph:

3.3.2.1 Substitution Request Forms submitted prior to receipt of bids will not be reviewed. Substitution requests must be submitted after contract award in order to be considered.
3.3.3 Delete this paragraph in its entirety and replace with the following:

3.3.3 Refer to Division 1 Section 01600 "Product Requirements" for requirements concerning the Standard of Quality and approval of substitutions.

3.3.4 Delete this paragraph in its entirety.

3.4 ADDENDA

3.4.1 Delete this paragraph in its entirety and replace with the following:

3.4.1 Addenda will be issued to bona fide bidders registered with the Construction Manager as having received a complete set of bid documents; addenda will not be issued to others.

ARTICLE 4 - BIDDING PROCEDURES

4.1 PREPARATION OF BIDS

Add the following clauses to subparagraph 4.1.1:

4.1.1.1 Bids shall be made on unaltered Bid Form(s) as provided with the Bidding Documents. Fill in all blank spaces. Submit two copies bearing original signatures for each bid.

4.1.1.2 Bids shall be signed and the name typed below the signature. Where Bidder is a corporation, Bids must be signed with the legal name of the corporation followed by the name of the State of Incorporation and the legal signature of an officer authorized to bind the corporation to a Contract.

4.1.1.3 Bids shall be on a lump-sum basis.

4.2 BID SECURITY

Add the following subparagraphs to 4.2:

4.2.4 For base bids equal to or greater than Ten Thousand Dollars, the bid shall be accompanied by a bid guarantee of not less than 10 percent of the amount of the Base Bid. Bid Security shall be by certified check, cashier check, or Bid Bond in the form of AIA Document A310, from an owner approved Surety Company licensed to conduct business in the Commonwealth of Pennsylvania, made payable to the Owner.

4.2.5 The Owner reserves the right to retain the Security of the three apparent low bidders on each contract until the Owner and the successful bidder for each contract have executed an Owner/Contractor agreement and the executed performance and Payment Bonds have been approved by the Owner, or until 45 days after bid opening, whichever is shorter. All other Bid Security will be returned as soon as practical.
4.3 SUBMISSION OF BIDS

Add the following subparagraph:

4.3.5 All bids must contain the following documents:
   1. A properly and completely filled out Bid Form, Section 00410.
   2. Bid Security for bids equal to or greater than $10,000.00.
   3. A properly completed Non Collusion Affidavit.
   4. A properly completed MBE/WBE Utilization Form.

Add the following Subparagraphs:

4.3.6 Certificates of Authority - Out-Of-State Contractors

4.3.6.1 As a precondition to the reading and acceptance of any Bid tendered by any bidder, company, or corporation not incorporated or registered in the Commonwealth of Pennsylvania, a “Certificate of Authority” shall be attached to their Bid Proposal.

4.3.6.2 This “Certificate of Authority” shall be issued by the Department of State, Commonwealth of Pennsylvania, pursuant to the provisions of Section 4121 of the “Business Corporation Law” of 1988 (15 Pa C.S. § 4121) of the Commonwealth of Pennsylvania.

4.3.6.3 Failure to attach said “Certificate of Authority” to his Bid Proposal will be judged as sufficient cause to reject the Bid Proposal of any “Foreign Business Corporation” as defined by the above-mentioned Act.

4.3.6.4 As of January 1998, the administration of this requirement was through the Pennsylvania Department of State, Corporation Bureau, Room 308, North Office Building, PO Box 8722, Harrisburg, PA 17105, Telephone (717) 787-1057.

4.3.7 Non-Collusion Affidavit

4.3.7.1 In accordance with the Pennsylvania Antibid-Rigging Act, 62 C.S.A., Section 4501, October 28, 1993, all bidders are required to submit with their bids a completed, signed, and notarized Non-Collusion Affidavit; refer to Division 0 Section 00453 - Non-Collusion Affidavit.

4.4.1 Delete this paragraph in its entirety and replace with the following:

A Bid may not be modified, withdrawn, or canceled by the Bidder during a period of sixty (60) days following the time and date designated for the receipt of bids, and each Bidder so agrees in submitting a bid. Bids may be withdrawn in compliance with all Pennsylvania laws, rules, and regulations.

ARTICLE 5 – CONSIDERATION OF BIDS

Add the following subparagraphs:

5.3.3 The Owner, Harrisburg Area Community College, reserves the right to waive any irregularities, omissions, errors, mistakes, or defects in any bid or to reject any or all bids, at its sole discretion.
5.3.4 The Owner reserves to right to allow a Bidder to correct a defect in its Bid provided that correction of the defect does not alter the amount of the Bid or the scope of work required under the Bid.

ARTICLE 6 - POST BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Add the following subparagraphs:

6.1.1 If a contractor's qualification statement has been submitted within the previous 12 months, it will not be required for this bid submission.

6.1.2 Bonding Capacity

6.1.2.1 The apparent low bidders shall, when requested by the Architect on behalf of the owner, furnish the owner additional information on the bidder's performance and labor and material payment bonding capacity, history and current rate charged.

6.1.2.2 Performance and payment bonds are not required for contracts of less than Fifty Thousand dollars.

6.2.2 Delete this paragraph in its entirety.

ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

7.1 BOND REQUIREMENTS

Delete Subparagraphs 7.1.1, 7.1.2, and 7.1.3 and replace with the following Subparagraphs:

7.1.1 For all contracts totaling Fifty Thousand Dollars or more, furnish and pay for bonds covering faithful performance of the contract and payment of all obligations arising there under. Furnish bonds in the amount of 100% of bid sum and in such form as the Owner may prescribe and with Surety company acceptable to the Owner.

7.1.2 The Contractor shall deliver said bonds to the owner not later than the date of execution of the contract. Failure or neglecting to deliver said bonds, as specified, shall be considered as having abandoned the contract and the bid Security will be retained as liquidated damages.

7.1.3 The Contractor shall provide a performance bond and a labor and material payment bond, each in the amount of 100% of the Contract Price, before the award of the Contract. (Sections 756 and 757 of the Public School Code of 1949, as amended, and the Public Works Contractors Bond Law of 1967.)

ARTICLE 8 - FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Delete the first paragraph of this Article and replace with the following:
Unless otherwise required in Bidding Documents, the Agreement for the Work will be written on AIA Document A101 CM/a, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment is a Stipulated Sum.

Add the following Paragraph to Article 8.

8.1 PREPARATION OF AGREEMENT

8.1.1 The successful bidder shall assist the Owner in preparing the agreement and within five days following its presentation shall execute the contract and return to the Owner.

Add the following Article:

ARTICLE 9 – CRIMINAL BACKGROUND CHECK

9.1 The safety and security of the Owner's students, faculty and staff is very important.

Owner shall require the successful bidder to have diligently performed criminal background checks of all employees that the successful bidder assigns to work within Owner's facilities and at or near the Owner's properties. Owner shall have the right to approve of the process that the successful bidder uses for completing the criminal background checks. If an individual has a verified criminal record, the successful bidder will be required to provide Owner with the criminal record information to determine suitability for placement in the on-site work.

The successful bidder agrees that it is liable for any damage to persons, property or reputation of the Owner in the event any unsuitable individuals are assigned to the College. If any doubt exists about the eligibility of an individual, the successful bidder will be responsible for bringing those issues to the attention of the Owner before assigning the individual to the Project.

END OF SECTION 00210
SECTION 00410 - BID FORM

PROJECT:  Repairs to Evans Gym Pools #10-23

BID TO:  Harrisburg Area Community College

BID FROM:  

1. The undersigned BIDDER agrees, if this Bid is accepted, to enter into an agreement with OWNER, in the form included in the Bidding Documents, to perform and furnish the Work as specified or indicated in the Bidding Documents for the Bid Price and within the Time indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

2. In submitting this Bid, BIDDER represents, acknowledges, and agrees, as more fully set forth in the Agreement, that:
   
   a. This Bid will remain subject to acceptance for 60 days after the date of Bid opening;
   b. The Owner has the right to reject this Bid, for its convenience. The Owner also reserves to right to allow a Bidder to correct a defect in its Bid provided that correction of the defect does not alter the amount of the Bid or the scope of work required under the Bid.
   c. BIDDER accepts the provisions of the Instructions and Supplementary Instructions to Bidders regarding disposition of Bid Security;
   d. BIDDER will sign and submit the Agreement with the Bonds and other documents required by the Bidding Requirements within 15 days after the date of Owner’s Notice of Award;
   e. BIDDER has examined and understands all Bidding Documents.
   f. BIDDER has visited site and become familiar with the general, local, and conditions; and that the Bidder has considered such laws and regulations in determining the cost, progress, performance, and furnishing of the Work for the Project;
   g. BIDDER is familiar with federal, state, and local laws and regulations;
   h. BIDDER is aware of the general nature of work to be performed by OWNER and others at the Site as such relates to the Work indicated in the Bidding Documents.
   i. BIDDER has correlated the information known to BIDDER, information and observations obtained from visits to the site, reports, and drawings identified in the Bidding Documents and additional examinations, investigations, explorations, tests, studies, and data with the Bidding Documents;
   j. BIDDER does not consider that any further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times and in accordance with the other terms and conditions of the Bidding Documents.
   k. This Bid is genuine and not made in the interest of or on behalf of an undisclosed person, firm, or corporation and is not submitted in conformity with an agreement or rules of a group, association, organization, or corporation; BIDDER has not directly or indirectly induced or solicited another Bidder to submit a false or sham Bid; BIDDER has not solicited or induced a person, firm, or corporation to refrain from bidding; and BIDDER has not sought by collusion to obtain for itself an advantage over another BIDDER or over OWNER.
I. BIDDER has received the following Addenda receipt of which is hereby acknowledged:

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**BASE BID**

3. BIDDER will complete the Work in accordance with the Contract Documents for the following STIPULATED-SUM BID PRICE:

$_________________________________________ (in words)

$_________________________________________ (in figures)

**ALTERNATES**

4. ALTERNATE #1 – Painting/Special Coatings

   ADD $_________________________________________ (in words)

   $_________________________________________ (in figures)

5. ALTERNATE #2 – Masonry Control Joints

   ADD $_________________________________________ (in words)

   $_________________________________________ (in figures)

6. ALTERNATE #3 – Acoustical Panels

   ADD $_________________________________________ (in words)

   $_________________________________________ (in figures)

7. ALTERNATE #4 – Benches

   ADD $_________________________________________ (in words)

   $_________________________________________ (in figures)
8. ALTERNATE #5 – Exterior Door

ADD $____________________________________ (in words)

$____________________________________ (in figures)

9. ALTERNATE #6 – Automated Pool Management System

ADD $____________________________________ (in words)

$____________________________________ (in figures)

10. ALTERNATE #7 – Pool Area Lighting

ADD $____________________________________ (in words)

$____________________________________ (in figures)

11. ALTERNATE #8 – Door Hardware

ADD $____________________________________ (in words)

$____________________________________ (in figures)

BIDDER agrees that the Work will be substantially complete and ready for final payment in accordance with the General Conditions on or before the dates or within the number of calendar days indicated in the Information for Bidders, Section 00150.

SUBMITTED: ____________________________, 20_______

TYPE or PRINT date and time of bid submission Here

**SUBMIT BID FORM AND ALL ATTACHMENTS IN DUPLICATE**

The following attached documents are made a condition of this Bid:

Attachments:

1. Bid Security - (Required for Base bids equal to or greater than $10,000.00)
2. Non - Collusion Affidavit
3. MBE/WBE Utilization Form
By: **When Bidder is an Individual**

Date: ____________________

(Legal Name of Contracting Firm Name) __________________________ (SEAL)

Business Address: ____________________________________________

Phone Number: __________________________ Fax: __________________

(Signature of Person Authorized to Sign) __________________________ (Signature of Witness)

(Printed name and Title of Person Authorized to Sign) ____________________ (Printed name of Witness)

By: **When Bidder is a Partnership**

Date: ____________________

(Legal Name of Contracting Firm Name) __________________________ (SEAL)

Business Address: ____________________________________________

Phone Number: __________________________ Fax: __________________

(Signature of Partner Authorized to Sign) __________________________ (Signature of Witness)

(Printed name of Partner Authorized to Sign) ____________________ (Printed name of Witness)

(Signature of Partner Authorized to Sign) __________________________ (Signature of Witness)

(Printed name of Partner Authorized to Sign) ____________________ (Printed name of Witness)

(Signature of Partner Authorized to Sign) __________________________ (Signature of Witness)

(Printed name of Partner Authorized to Sign) ____________________ (Printed name of Witness)
By: **When Bidder is a Corporation**

Date: __________  __________

(Legal Name of Corporation) ____________________________ (SEAL)

Incorporated under the laws of: ____________________________ (Printed Name of State)

Business Address: ______________________________________

Phone Number: ________________  Fax: ______________________

(Signature of Authorized Officer) ____________________________

(Signature of Corporate Secretary) ____________________________

(Printed name and Title of Authorized Officer) ____________________________

(Printed name of Corporate Secretary) ____________________________

By: **When Bidder is a Limited Liability Corporation (LLC)**

Date: ________________

(Legal Name of Limited Liability Corporation [LLC]) ____________________________ (SEAL)

Incorporated under the laws of: ____________________________ (Printed Name of State)

Business Address: ______________________________________

Phone Number: ________________  Fax: ______________________

(Signature of Authorized Officer) ____________________________

(Signature of Corporate Secretary) ____________________________

(Printed name and Title of Authorized Officer) ____________________________

(Printed name of Corporate Secretary) ____________________________

**END OF BID FORM**
SECTION 00430 – BID BOND

The attached form AIA 310 shall be submitted for all bids with a value of ten thousand dollars ($10,000.00) or greater. Failure to submit this required form may subject bid to rejection.

END OF SECTION 00430
Bid Bond

KNOW ALL MEN BY THESE PRESENTS, that we
(Here insert full name and address or legal title of Contractor)

as Principal, hereinafter called the Principal, and
(Here insert full name and address or legal title of Surety)

a corporation duly organized under the laws of the State of called the Surety, hereinafter
(Here insert full name and address or legal title of Owner)

as Obligee, hereinafter called the Obligee, in the sum of  ($  ), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for
(Here insert full name, address and description of project)

Sample

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith enter into a Contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.
Signed and sealed this __ day of __.

(Principal)  
(Seal)

(Witness)

(Title)

(Witness)

(Surety)

(Title)  
(Seal)
SECTION 00440 – MBE/WBE UTILIZATION FORM

The MBE/WBE Utilization Form included in this section is to be properly filled out, signed and included with Bid Form as noted. Failure to submit this required form may subject bid to rejection.

Instructions:

1. Provide your company name, contract, and bid submission date.

2. Enter the subcontractor’s or supplier’s company name which is mandatory, telephone number with area code, and contract person’s name.

3. You must indicate if you desire credit for the firm as either MBE or WBE.

4. Enter the total dollar amount of the quote received. If the quote is received in the form of unit prices, hourly rates, etc., a total dollar amount should be provided.

5. You must include both solicited and unsolicited quotes within the scope of work. Failure to include a firm providing solicited or unsolicited quotes may result in the rejection of the bid as not responsive.

6. The MBE/WBE form must be completed and submitted with all bids. Failure to properly complete the form will cause the bid to be rejected as non-responsive.

END OF SECTION 00440
HARRISBURG AREA COMMUNITY COLLEGE
REPAIRS TO EVANS GYM POOLS

MINORITY BUSINESS ENTERPRISE / WOMEN'S BUSINESS ENTERPRISE UTILIZATION FORM

Contractor Name: ___________________________ Contract: ______________ Submission Date: __________________

The Contractor submitting this form certifies that in its solicitations for subcontractor and supplier participation on the above referenced project, it has made every attempt to contact and solicit Minority Business Enterprise and Women’s Business Enterprise (WBE/MBE) firms to submit bids for portions of the Work. The list below represents the known MBE/WBE firms with whom the Contractor has solicited work or received non-solicited bids. Use multiple copies of this form as needed.

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Signature of Person authorized to sign: ___________________________

Printed Name and Title: _________________________________________
SECTION 00453 - NON-COLLUSION AFFIDAVIT

The Non-Collusion Affidavit included in this section is to be properly filled out, signed, notarized, and included with Bid Form as noted. Failure to submit this required form may subject bid to rejection.
Harrisburg Area Community College

State of _____________________________ (Printed Name of State in which Project is Located)

§

County of ____________________________ (Printed Name of County in which Project is Located)

I _______________________________ of the City of ___________________________ in

(Printed name of individual attesting) (Printed Name of city in which you reside)

the County of ___________________________ and the State of ___________________________

(Printed Name of County in which you reside) (Printed Name of State in which you reside)

of full age, being Duly sworn according to the law on my oath depose and say that:

I am the ______________________ of the firm of ___________________________

(Printed Title) (Printed Name of Company)

of __________________________________________

(Printed Address of Company, Including State and Zip code)

the bidder making a Proposal for the above-named project, and that I executed the said Proposal with full

authority so to do; that said bidder has not, directly or indirectly, entered into any agreement, participated in

any collusion, or otherwise taken any action in restraint of free, competitive bidding in connection with the

above-named project; and that all statements contained in said Proposal and in this affidavit are true and

correct, and made with full knowledge that the Owner,

HARRISBURG AREA COMMUNITY COLLEGE

relies upon the truth of the statements contained in said Proposal and in the statements contained in this

affidavit in awarding the contract for the said Project.

I further warrant that no person or selling agency has been employed or retained to solicit or secure such

contract upon an Agreement or understanding for a commission, percentage brokerage or contingent fee,

except bona fide employees or bona fide established commercial or selling agencies maintained by

________________________________________________________

(Printed name of Bidder/Organization).

Commonwealth of Pennsylvania

County of ____________________________

On this, the ______ day of ____________, 20____, before me a notary public, the undersigned officer, personally appeared

known to me (or satisfactorily proven) to be the person whose name is

subscribed to the within instrument, and acknowledged that he/she

executed the same for the purposes therein contained.

In witness hereof, I hereunto set my hand and official seal.

________________________________________________________

Signature of Bidder/Organization

________________________________________________________

Signature of Notary

Notary Seal

NON-COLLUSION AFFIDAVIT

00453 - 2
SECTION 00500 – STANDARD FORM OF AGREEMENT – AIA DOCUMENT A101/CMa

The attached AIA Document A101/CMa -1992 shall be the contract format for the project.

END OF SECTION 00500
AGREEMENT
made as of the ___ day of ____, in the year of ___
(In words, indicate day, month and year)

BETWEEN the Owner:
(Name and address)

and the Contractor:
(Name and address)

For the following Project:
(Include detailed description of Project, location, address and scope.)

SAMPLE

The Construction Manager is:
(Name and address)

The Architect is:
(Name and address)

The Owner and Contractor agree as set forth below.
ARTICLE 1 THE CONTRACT DOCUMENTS
The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement; these form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than Modifications, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT
The Contractor shall execute the entire Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others, or as follows:

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
§ 3.1 The date of commencement is the date from which the Contract Time of Section 3.2 is measured, and shall be the date of this Agreement, as first written above, unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Insert the date of commencement, if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

Unless the date of commencement is established by a notice to proceed issued by the Owner, the Contractor shall notify the Owner, through the Construction Manager, in writing not less than five days before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

§ 3.2 The Contractor shall achieve Substantial Completion of the entire Work not later than ( ) days after the Date of Commencement.
(Insert the calendar date or number of calendar days after the date of commencement. Also insert any requirements for earlier Substantial Completion of certain portions of the Work, if not stated elsewhere in the Contract Documents.)

<table>
<thead>
<tr>
<th>Portion of Work</th>
<th>Substantial Completion date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to complete on time.)

ARTICLE 4 CONTRACT SUM
§ 4.1 The Owner shall pay the Contractor in current funds for the Contractor's performance of the Contract the Contract Sum of ($ ), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If decisions on other alternates are to be made by the Owner subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date until which that amount is valid.)

§ 4.3 Unit prices, if any, are as follows:
ARTICLE 5 PROGRESS PAYMENTS

§ 5.1 Based upon Applications for Payment submitted by the Contractor to the Construction Manager, and upon Project Applications and Certificates for Payment issued by the Construction Manager and Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.3 Provided an Application for Payment is submitted to the Construction Manager not later than the twenty-fifth (25th) day of a month, the Owner shall make payment to the Contractor not later than the thirtieth (30th) day of the following month. If an Application for Payment is received by the Construction Manager after the application date fixed above, payment shall be made by the Owner not later than thirty (30) days after the Construction Manager receives the Application for Payment.

§ 5.4 Each Application for Payment shall be based upon the Schedule of Values submitted by the Contractor in accordance with the Contract Documents. The Schedule of Values shall allocate the entire Contract Sum among the various portions of the Work and be prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager or Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment.

§ 5.5 Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.6 Subject to the provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.6.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the total Contract Sum allocated to that portion of the Work in the Schedule of Values, less retainage of ten percent (10%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Section 7.3.7 of the General Conditions;

§ 5.6.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of ten percent (10%);

§ 5.6.3 Subtract the aggregate of previous payments made by the Owner; and

§ 5.6.4 Subtract amounts, if any, for which the Construction Manager or Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of the General Conditions.

§ 5.7 The progress payment amount determined in accordance with Section 5.6 shall be further modified under the following circumstances:

§ 5.7.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to one hundred percent (100%) of the Contract Sum, less such amounts as the Construction Manager recommends and the Architect determines for incomplete Work and unsettled claims. At a minimum, the value will be one hundred fifty percent (150%) of the value of the Punchlist and uncompleted work.
§ 5.7.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of the General Conditions.

§ 5.8 Reduction or limitation of retainage, if any, shall be as follows:
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.6.1 and 5.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

ARTICLE 6 FINAL PAYMENT
Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when (1) the Contract has been fully performed by the Contractor except for the Contractor’s responsibility to correct nonconforming Work as provided in Section 12.2.2 of the General Conditions and to satisfy other requirements, if any, which necessarily survive final payment; and (2) a final Project Certificate for Payment has been issued by the Construction Manager and Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the final Project Certificate for Payment, or as follows:

ARTICLE 7 MISCELLANEOUS PROVISIONS
§ 7.1 Where reference is made in this Agreement to a provision of the General Conditions or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 7.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

( ) per annum

(Usury laws and requirements under the Federal Truth in Lending Act, similar state and local consumer credit laws and other regulations at the Owner's and Contractor's principal places of business, the location of the Project and elsewhere may affect the validity of this provision. Legal advice should be obtained with respect to deletions or modifications, and also regarding requirements such as written disclosures or waivers.)

§ 7.3 Temporary facilities and services:
(Here insert temporary facilities and services which are different from or in addition to those included elsewhere in the Contract Documents.)

§ 7.4 Other Provisions:
(Here list any special provisions affecting the Contract.)

ARTICLE 8 TERMINATION OR SUSPENSION
§ 8.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of the General Conditions.

§ 8.2 The Work may be suspended by the Owner as provided in Article 14 of the General Conditions.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS
§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated as follows:
§ 9.1.1 The Agreement is this executed Standard Form of Agreement Between Owner and Contractor, AIA Document A101/CMa, 1992 Construction Manager-Adviser Edition.


§ 9.1.3 The Supplementary and other Conditions of the Contract are those contained in the Project Manual dated __________ and are as follows:

<table>
<thead>
<tr>
<th>Document</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
</table>

§ 9.1.4 The Specifications are those contained in the Project Manual dated as in Section 9.1.3, and are as follows:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

| Title of Specifications: |
| (Table deleted) |

§ 9.1.5 The Drawings are as follows, and are dated __________ unless a different date is shown below:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

| Title of Drawings: |
| (Table deleted) |

§ 9.1.6 The Addenda, if any, are as follows:

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Pages</th>
</tr>
</thead>
</table>

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Other documents, if any, forming part of the Contract Documents are as follows:
(List here any additional documents which are intended to form part of the Contract Documents. The General Conditions provide that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor’s bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

Contractor’s Release of Liens and Claims

This Agreement is entered into as of the day and year first written above and is executed in at least four original copies of which one is to be delivered to the Contractor, one each to the Construction Manager and Architect for use in the administration of the Contract, and the remainder to the Owner.

OWNER

(Signature)

(Printed name and title)

CONTRACTOR

(Signature)

(Printed name and title)
SECTION 00615 – PERFORMANCE AND PAYMENT BONDS

The attached form AIA 312 shall be submitted for all contracts having a value of fifty thousand dollars ($50,000.00) or greater.

Recent state and federal court decisions have interpreted Section 6 of the AIA A312™ 1984 Payment Bond form. Those decisions have held that sureties that do not send an answer to the claimant within 45 days have waived the right to subsequently dispute claims. As a result, several national surety companies have refused to issue payment bonds without significant modifications to the language of A312-1984. Those modifications are not consistent nationwide and may alter the rights and obligations of the claimant and surety.

As a stopgap measure to address the immediate concerns of the sureties, and until such time as the AIA can consider a comprehensive revision of A312-1984, the AIA has authorized the following amendment to A312-1984. The AIA believes that this amendment addresses the sureties’ concerns over waiver of defenses, and balances those concerns against the interests of the claimants.

The AIA recommends amending Section 6 of A312-1984 as follows:

§6 When the Claimant has satisfied the conditions of Section 4, the Surety shall promptly and at the Surety’s expense take the following actions:

§6.1 Send an answer to the Claimant, with a copy to the Owner, within 60 days after the receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

§6.2 Pay or arrange for payment of any undisputed amounts.

§6.3 The Surety’s failure to discharge its obligations under this Section 6 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a claim. However, if the Surety fails to discharge its obligations under this Section 6, the Surety shall indemnify the Claimant for the reasonable attorney’s fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.

END OF SECTION 00615
Performance Bond

CONTRACTOR (Name and Address):

SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond: [X] None [ ] See Last Page

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)
Signature: __________________________
Name and Title: __________________________
(Any additional signatures appear on the last page)

SURETY
Company: (Corporate Seal)
Signature: __________________________
Name and Title: __________________________

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.

Any singular reference to Contract, Surety, Owner or other party shall be considered plural where applicable.

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User Notes:
§ 1 The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Section 3.1.

§ 3 If there is no Owner Default, the Surety’s obligation under this Bond shall arise after:

§ 3.1 The Owner has notified the Contractor and the Surety at its address described in Section 10 below that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner’s right, if any, subsequently to declare a Contractor Default; and

§ 3.2 The Owner has declared a Contractor Default and formally terminated the Contractor’s right to complete the contract. Such Contractor Default shall not be declared earlier than twenty days after the Contractor and the Surety have received notice as provided in Section 3.1; and

§ 3.3 The Owner has agreed to pay the Balance of the Contract Price to the Surety in accordance with the terms of the Construction Contract or to a contractor selected to perform the Construction Contract in accordance with the terms of the contract with the Owner.

§ 4 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety’s expense take one of the following actions:

§ 4.1 Arrange for the Contractor, with consent of the Owner, to perform and complete the Construction Contract; or

§ 4.2 Undertake to perform and complete the Construction Contract itself, through its agents or through independent contractors; or

§ 4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and the contractor selected with the Owner’s concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor’s default; or

§ 4.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, tender payment therefor to the Owner; or

.2 Deny liability in whole or in part and notify the Owner citing reasons therefor.

§ 5 If the Surety does not proceed as provided in Section 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 4.4, and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 6 After the Owner has terminated the Contractor’s right to complete the Construction Contract, and if the Surety elects to act under Section 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:
§ 6.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

§ 6.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 4; and

§ 6.3 Liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 7 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators or successors.

§ 8 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 9 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 10 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.

§ 11 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 12 DEFINITIONS

§ 12.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 12.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

§ 12.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

§ 12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.
§ 13 MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

SURETY
Company: (Corporate Seal)

Signature: ____________________________
Name and Title: _______________________
Address: ______________________________

Signature: ____________________________
Name and Title: _______________________
Address: ______________________________
Payment Bond

CONTRACTOR (Name and Address): SURETY (Name and Principal Place of Business):

OWNER (Name and Address):

CONSTRUCTION CONTRACT
Date:
Amount:
Description (Name and Location):

BOND
Date (Not earlier than Construction Contract Date):
Amount:
Modifications to this Bond: [X] None [ ] See Last Page

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

SURETY
Company: (Corporate Seal)

Signature: ____________________________
Name and Title: ____________________________
(Any additional signatures appear on the last page)

FOR INFORMATION ONLY - Name, Address and Telephone
AGENT or BROKER: ____________________________
OWNER'S REPRESENTATIVE (Architect, Engineer or other party): ____________________________
§ 1 The Contractor and the Surety, jointly and severally bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 With respect to the Owner, this obligation shall be null and void if the Contractor:
§ 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

§ 2.2 Defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity whose claim, demand, lien or suit is for the payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Section 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is no Owner Default.

§ 3 With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

§ 4 The Surety shall have no obligation to Claimants under this Bond until:
§ 4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Section 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

§ 4.2 Claimants who do not have a direct contract with the Contractor:
   .1 Have furnished written notice to the Contractor and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and
   .2 Have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and
   .3 Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Section 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

§ 5 If a notice required by Section 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

§ 6 When the Claimant has satisfied the conditions of Section 4, the Surety shall promptly and at the Surety’s expense take the following actions:
§ 6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

§ 6.2 Pay or arrange for payment of any undisputed amounts.

§ 7 The Surety’s total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 8 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any Construction Performance Bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Owner’s priority to use the funds for the completion of the work.

§ 9 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

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User Notes:
§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Section 4.1 or Section 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 15 DEFINITIONS
§ 15.1 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 15.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

§ 15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

§ 16 MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL
Company: (Corporate Seal)

SURETY
Company: (Corporate Seal)

Signature:
Name and Title:
Address:

Signature:
Name and Title:
Address:
SECTION 00620 - CERTIFICATE OF INSURANCE

The attached Certificate of Insurance (Acord Certificate of Insurance, AIA Document G715) shall be completed and submitted according to the provisions of Section 00800 - Supplemental General Conditions, Article 11, paragraph 11.1.3.1:

The following information shall be indicated on the Certificate:

**Project Name:** Repairs to Evans Gym Pools

**Project Location:** Harrisburg, PA

**County:** Dauphin

**Certificate Holder:** Harrisburg Area Community College

**Additional Insured:**
- Harrisburg Area Community College
- Eastern pcm, LLC
- Johnson, Mirmiran, Thompson

Certificates not bearing the required information will be discarded and no credit given to the Contractor for having submitted such.

END OF SECTION 00620
Supplemental Attachment for ACORD Certificate of Insurance 25-S

(This document replaces AIA Document G705, Certificate of Insurance.)

PROJECT (Name and address):
Sample

INSURED

A. General Liability
   1. Does the General Aggregate apply to this Project only? 
   Yes No N/A
   2. Does this policy include coverage for:
      a. Premises - Operations?
      b. Explosion, Collapse and Underground Hazards?
      c. Personal Injury Coverage?
      d. Products Coverage?
      e. Completed Operations?
      f. Contractual Coverage for the Insured's obligations in A201?
   3. If coverage is written on a claims-made basis, what is the:
      a. Retroactive Date?
      b. Extended Reporting Date?

B. Worker's Compensation
   1. If the Insured is exempt from Worker's Compensation statutes, does the Insured carry the equivalent Voluntary Compensation coverage?
   Yes No N/A

C. Final Payment Information
   1. Is this certificate being furnished in connection with the Contractor's request for final payment in accordance with the requirements of Sections 9.10.2 and 11.1.3 of AIA Document A201, General Conditions of the Contract for Construction?
   Yes No N/A
   2. If so, and if the policy period extends beyond termination of the Contract for Construction, is Completed Operations coverage for this Project continued for the balance of the policy period?
   Yes No N/A

D. Termination Provisions
   1. Has each policy shown on the certificate and this Supplement been endorsed to provide the holder with 30 days notice of cancellation and/or expiration? List below any policies which do not contain this notice.
   Yes No N/A

E. Other Provisions

Authorized Representative

Date of Issue

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SECTION 00700

GENERAL CONDITIONS OF THE CONTRACT – AIA DOCUMENT A201/CMa – 1992

The attached AIA Document A201/CMa – 1992 shall be the contract format for the project.

END OF SECTION 00700
General Conditions of the Contract for Construction
where the Construction Manager is NOT a Constructor

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

THE OWNER:
(Name and address):

THE ARCHITECT:
(Name and address):

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ARTICLE 1  GENERAL PROVISIONS
§ 1.1 BASIC DEFINITIONS
§ 1.1.1 THE CONTRACT DOCUMENTS
The Contract Documents consist of the Agreement between Owner and Contractor (hereinafter the Agreement), Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include other documents such as bidding requirements (advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or portions of addenda relating to bidding requirements).

§ 1.1.2 THE CONTRACT
The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Architect and Contractor, (2) between the Construction Manager and Contractor, (3) between the Architect and Construction Manager, (4) between the Owner and a Subcontractor or Sub-subcontractor or (5) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

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

§ 1.1.4 THE PROJECT
The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Contractors and by the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager.

§ 1.1.5 THE DRAWINGS
The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

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

§ 1.1.7 THE PROJECT MANUAL
The Project Manual is the volume usually assembled for the Work which may include the bidding requirements, sample forms, Conditions of the Contract and Specifications.

§ 1.2 EXECUTION, CORRELATION AND INTENT
§ 1.2.1 The Contract Documents shall be signed by the Owner and Contractor as provided in the Agreement. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

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

§ 1.2.3 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent
consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

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

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

§ 1.3 OWNERSHIP AND USE OF ARCHITECT’S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS
§ 1.3.1 The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect’s service through which the Work to be executed by the Contractor is described. The Contractor may retain one contract record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect, and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common law, statutory and other reserved rights, in addition to the copyright. All copies of them, except the Contractor’s record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner and Architect. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect. Submission or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect’s copyright or other reserved rights.

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

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

ARTICLE 2 OWNER
§ 2.1 DEFINITION
§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term “Owner” means the Owner or the Owner’s authorized representative.

§ 2.1.2 The Owner upon reasonable written request shall furnish to the Contractor in writing information which is necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic’s lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner’s interest therein at the time of execution of the Agreement and, within five days after any change, information of such change in title, recorded or unrecorded.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER
§ 2.2.1 The Owner shall, at the request of the Contractor, prior to execution of the Agreement and promptly from time to time thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner’s obligations under the Contract.

[Note: Unless such reasonable evidence were furnished on request prior to the execution of the Agreement, the prospective contractor would not be required to execute the Agreement or to commence the Work.]
§ 2.2.2 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site.

§ 2.2.3 Except for permits and fees which are the responsibility of the Contractor under the Contract Documents, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit.

§ 2.2.4 Information or services under the Owner’s control shall be furnished by the Owner with reasonable promptness to avoid delay in orderly progress of the Work.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work.

§ 2.2.6 The Owner shall forward all communications to the Contractor through the Construction Manager and shall contemporaneously provide the same communications to the Architect.

§ 2.2.7 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Article 6 (Construction by Owner or by Other Contractors), Article 9 (Payments and Completion) and Article 11 (Insurance and Bonds).

§ 2.3 OWNER’S RIGHT TO STOP THE WORK
§ 2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Owner, by written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

§ 2.4 OWNER’S RIGHT TO CARRY OUT THE WORK
§ 2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a second seven-day period. If the Contractor within such second seven-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Construction Manager’s and Architect’s and their respective consultants’ additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR
§ 3.1 DEFINITION
§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout this Agreement as if singular in number. The term "Contractor" means the Contractor or the Contractor’s authorized representative.

§ 3.1.2 The plural term "Contractors" refers to persons or entities who perform construction under Conditions of the Contract that are administered by the Construction Manager, and that are identical or substantially similar to these Conditions.
§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR
§ 3.2.1 The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Section 2.2.2 and shall at once report to the Construction Manager and Architect errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner, Construction Manager or Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor recognized such error, inconsistency or omission and knowingly failed to report it to the Construction Manager and Architect. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Construction Manager and Architect, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

§ 3.2.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Construction Manager and Architect at once.

§ 3.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Section 3.12.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES
§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor’s best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under this Contract, subject to overall coordination of the Construction Manager as provided in Sections 4.6.3 and 4.6.4.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor’s employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

§ 3.3.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons other than the Contractor.

§ 3.3.4 The Contractor shall inspect portions of the Project related to the Contractor’s Work in order to determine that such portions are in proper condition to receive subsequent Work.

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

§ 3.4.2 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.

§ 3.5 WARRANTY
§ 3.5.1 The Contractor warrants to the Owner, Construction Manager and Architect that materials and equipment furnished under the Contract will be of good quality and new unless otherwise required or permitted by the Contract Documents, that the Work will be free from defects not inherent in the quality required or permitted, and that the Work will conform with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Contractor’s warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.
§ 3.6 TAXES
§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES AND NOTICES
§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner shall secure and pay for the building permit and the Contractor shall secure and pay for all other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules and regulations and lawful orders of public authorities bearing on performance of the Work.
§ 3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Construction Manager, Architect and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

§ 3.7.4 If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Construction Manager, Architect and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

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

§ 3.8.2 Unless otherwise provided in the Contract Documents:
  .1 materials and equipment under an allowance shall be selected promptly by the Owner to avoid delay in the Work;
  .2 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
  .3 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum and not in the allowances;
  .4 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.2 and (2) changes in Contractor's costs under Section 3.8.2.3.

§ 3.9 SUPERINTENDENT
§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULE
§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's Construction Schedule for the Work. Such schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project construction schedule to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.
§ 3.10.2 The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor’s Work to avoid conflict, delay in or interference with the Work of other Contractors or the construction or operations of the Owner’s own forces.

§ 3.10.3 The Contractor shall prepare and keep current, for the Construction Manager’s and Architect’s approval, a schedule of submittals which is coordinated with the Contractor’s Construction Schedule and allows the Construction Manager and Architect reasonable time to review submittals.

§ 3.10.4 The Contractor shall conform to the most recent schedules.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE
§ 3.11.1 The Contractor shall maintain at the site for the Owner one record copy of the Drawings, Specifications, addenda, Change Orders and other Modifications, in good order and marked correctly to record changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Construction Manager and Architect and shall be delivered to the Construction Manager for submittal to the Owner upon completion of the Work.

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

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

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

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect is subject to the limitations of Section 4.6.12.

§ 3.12.5 The Contractor shall review, approve and submit to the Construction Manager, in accordance with the schedule and sequence approved by the Construction Manager, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor’s Shop Drawings, Product Data, Samples and similar submittals with related documents submitted by other Contractors. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action.

§ 3.12.6 The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Construction Manager and Architect. Such Work shall be in accordance with approved submittals.

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

§ 3.12.8 The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Construction Manager’s and Architect’s approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Construction Manager and Architect in writing of such deviation at the time of submittal and the Construction Manager and Architect have given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Construction Manager’s and Architect’s approval thereof.
§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals.

§ 3.12.10 Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents.

§ 3.12.11 When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Construction Manager and Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

§ 3.13 USE OF SITE
§ 3.13.1 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 materials or equipment.

§ 3.13.2 The Contractor shall coordinate the Contractor’s operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.14 CUTTING AND PATCHING
§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner's own forces or of other Contractors by cutting, patching, excavating or otherwise altering such construction. The Contractor shall not cut or otherwise alter such construction by other Contractors or by the Owner's own forces except with written consent of the Construction Manager, Owner and such other Contractors; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the other Contractors or the Owner the Contractor's consent to cutting or otherwise altering the Work.

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

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Construction Manager may do so with the Owner's approval and the cost thereof shall be charged to the Contractor.

§ 3.16 ACCESS TO WORK
§ 3.16.1 The Contractor shall provide the Owner, Construction Manager and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES AND PATENTS
§ 3.17.1 The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of patent rights and shall hold the Owner, Construction Manager 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. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

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

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

§ 3.18.3 The obligations of the Contractor under this Section 3.18 shall not extend to the liability of the Construction Manager, Architect, their consultants, and agents and employees of any of them arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Construction Manager, Architect, their consultants, and agents and employees of any of them provided such giving or failure to give is the primary cause of the injury or damage.

**ARTICLE 4 ADMINISTRATION OF THE CONTRACT**

§ 4.1 ARCHITECT

§ 4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture 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 the Architect's authorized representative.

§ 4.2 CONSTRUCTION MANAGER

§ 4.2.1 The Construction Manager 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 term "Construction Manager" means the Construction Manager or the Construction Manager's authorized representative.

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

§ 4.4 In case of termination of employment of the Construction Manager or Architect, the Owner shall appoint a construction manager or architect against whom the Contractor makes no reasonable objection and whose status under the Contract Documents shall be that of the former construction manager or architect, respectively.

§ 4.5 Disputes arising under Sections 4.3 and 4.4 shall be subject to arbitration.

§ 4.6 ADMINISTRATION OF THE CONTRACT

§ 4.6.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents, and will be the Owner's representatives (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the correction period described in Section 12.2. The Construction Manager and Architect will advise and consult with the Owner and will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract.

§ 4.6.2 The Construction Manager will determine in general that the Work is being performed in accordance with the requirements of the Contract Documents, will keep the Owner informed of the progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work.

§ 4.6.3 The Construction Manager will provide for coordination of the activities of other Contractors and of the Owner's own forces with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other Contractors and the Construction Manager and Owner in reviewing their construction schedules when directed to do so. The Contractor shall make any revisions to the construction schedule deemed
necessary after a joint review and mutual agreement. The construction schedules shall constitute the schedules to be used by the Contractor, other Contractors, the Construction Manager and the Owner until subsequently revised.

§ 4.6.4 The Construction Manager will schedule and coordinate the activities of the Contractors in accordance with the latest approved Project construction schedule.

§ 4.6.5 The Architect will visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work and to determine in general if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work. On the basis of on-site observations as an architect, the Architect will keep the Owner informed of progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work.

§ 4.6.6 The Construction Manager, except to the extent required by Section 4.6.4, and Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor’s responsibility as provided in Section 3.3, and neither will be responsible for the Contractor’s failure to carry out the Work in accordance with the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

§ 4.6.7 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall communicate through the Construction Manager, and shall contemporaneously provide the same communications to the Architect. Communications by and with the Architect’s consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect.

§ 4.6.8 The Construction Manager will review and certify all Applications for Payment by the Contractor, including final payment. The Construction Manager will assemble each of the Contractor’s Applications for Payment with similar Applications from other Contractors into a Project Application and Project Certificate for Payment. After reviewing and certifying the amounts due the Contractors, the Construction Manager will submit the Project Application and Project Certificate for Payment, along with the applicable Contractors’ Applications and Certificates for Payment, to the Architect.

§ 4.6.9 Based on the Architect’s observations and evaluations of Contractors’ Applications for Payment, and the certifications of the Construction Manager, the Architect will review and certify the amounts due the Contractors and will issue a Project Certificate for Payment.

§ 4.6.10 The Architect will have authority to reject Work which does not conform to the Contract Documents, and to require additional inspection or testing, in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed, but will take such action only after notifying the Construction Manager. Subject to review by the Architect, the Construction Manager will have the authority to reject Work which does not conform to the Contract Documents. Whenever the Construction Manager considers it necessary or advisable for implementation of the intent of the Contract Documents, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.6.18 through 4.6.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect’s nor the Construction Manager’s authority to act under this Section 4.6.10 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.6.11 The Construction Manager will receive from the Contractor and review and approve all Shop Drawings, Product Data and Samples, coordinate them with information received from other Contractors, and transmit to the
Architect those recommended for approval. The Construction Manager’s actions will be taken with such reasonable promptness as to cause no delay in the Work of the Contractor or in the activities of other Contractors, the Owner, or the Architect.

§ 4.6.12 The Architect will review and approve or take other appropriate action upon the Contractor’s submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect’s action will be taken with such reasonable promptness as to cause no delay in the Work of the Contractor or in the activities of the other Contractors, the Owner, or the Construction Manager, while allowing sufficient time in the Architect’s professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect’s review of the Contractor’s submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect’s review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect’s approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.6.13 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.6.14 Following consultation with the Construction Manager, the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7 and will have authority to order minor changes in the Work as provided in Section 7.4.

§ 4.6.15 The Construction Manager will maintain at the site for the Owner one record copy of all Contracts, Drawings, Specifications, addenda, Change Orders and other Modifications, in good order and marked currently to record all changes and selections made during construction, and in addition approved Shop Drawings, Product Data, Samples and similar required submittals. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.6.16 The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and final completion, and will receive and forward to the Architect written warranties and related documents required by the Contract and assembled by the Contractor. The Construction Manager will forward to the Architect a final Project Application and Project Certificate for Payment upon compliance with the requirements of the Contract Documents.

§ 4.6.17 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect’s responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.6.18 The Architect will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of the Construction Manager, Owner or Contractor. The Architect’s response to such requests will be made with reasonable promptness and within any time limits agreed upon. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Section 4.6, then delay shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

§ 4.6.19 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.6.20 The Architect’s decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.
§ 4.7 CLAIMS AND DISPUTES

§ 4.7.1 Definition. A Claim is a demand or assertion by one of the parties 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 made by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 4.7.2 Decision of Architect. Claims, including those alleging an error or omission by the Construction Manager or Architect, shall be referred initially to the Architect for action as provided in Section 4.8. A decision by the Architect, as provided in Section 4.8.4, shall be required as a condition precedent to arbitration or litigation of a Claim between the Contractor and Owner as to all such matters arising prior to the date final payment is due, regardless of (1) whether such matters relate to execution and progress of the Work or (2) the extent to which the Work has been completed. The decision by the Architect in response to a Claim shall not be a condition precedent to arbitration or litigation in the event (1) the position of Architect is vacant, (2) the Architect has not received evidence or has failed to render a decision within agreed time limits, (3) the Architect has failed to take action required under Section 4.8.4 within 30 days after the Claim is made, (4) 45 days have passed after the Claim has been referred to the Architect or (5) the Claim relates to a mechanic's lien.

§ 4.7.3 Time Limits on Claims. Claims by either party must be made within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.

§ 4.7.4 Continuing Contract Performance. Pending final resolution of a Claim including arbitration, unless otherwise agreed in writing, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 4.7.5 Waiver of Claims: Final Payment. The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

1. liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
2. failure of the Work to comply with the requirements of the Contract Documents; or
3. terms of special warranties required by the Contract Documents.

§ 4.7.6 Claims for Concealed or Unknown Conditions. If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 days after the Architect has given notice of the decision. If the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Section 4.8.

§ 4.7.7 Claims for Additional Cost. If the Contractor wishes to make 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 arising under Section 10.3. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with the procedure established herein.

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User Notes:
§ 4.7.8 Claims for Additional Time.

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

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

§ 4.7.9 Injury or Damage to Person or Property. If either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in Sections 4.7.7 or 4.7.8.

§ 4.8 RESOLUTION OF CLAIMS AND DISPUTES
§ 4.8.1 The Architect will review Claims and take one or more of the following preliminary actions within ten days of receipt of a Claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Architect expects to take action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Architect may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

§ 4.8.2 If a Claim has been resolved, the Architect will prepare or obtain appropriate documentation.

§ 4.8.3 If a Claim has not been resolved, the party making the Claim shall, within ten days after the Architect's preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Architect, (2) modify the initial Claim or (3) notify the Architect that the initial Claim stands.

§ 4.8.4 If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven days, which decision shall be final and binding on the parties but subject to arbitration. Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor's default, the Architect may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 4.9 ARBITRATION
§ 4.9.1 Controversies and Claims Subject to Arbitration. Any controversy or Claim arising out of or related to the Contract, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator or arbitrators may be entered in any court having jurisdiction thereof, except controversies or Claims relating to aesthetic effect and except those waived as provided for in Section 4.7.5. Such controversies or Claims upon which the Architect has given notice and rendered a decision as provided in Section 4.8.4 shall be subject to arbitration upon written demand of either party. Arbitration may be commenced when 45 days have passed after a Claim has been referred to the Architect as provided in Section 4.7 and no decision has been rendered.

§ 4.9.2 Rules and Notices for Arbitration. Claims between the Owner and Contractor not resolved under Section 4.8 shall, if subject to arbitration under Section 4.9.1, be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect, unless the parties mutually agree otherwise. Notice of demand for arbitration shall be filed in writing with the other party to the Agreement between the Owner and Contractor and with the American Arbitration Association, and copies shall be filed with the Construction Manager and Architect.

§ 4.9.3 Contract Performance During Arbitration. During arbitration proceedings, the Owner and Contractor shall comply with Section 4.7.4.
§ 4.9.4 When Arbitration May Be Demanded. Demand for arbitration of any Claim may not be made until the earlier of (1) the date on which the Architect has rendered a final written decision on the Claim, (2) the tenth day after the parties have presented evidence to the Architect or have been given reasonable opportunity to do so, if the Architect has not rendered a final written decision by that date, or (3) any of the five events described in Section 4.7.2.

§ 4.9.4.1 When a written decision of the Architect states that (1) the decision is final but subject to arbitration and (2) a demand for arbitration of a Claim covered by such decision must be made within 30 days after the date on which the party making the demand receives the final written decision, then failure to demand arbitration within said 30 days' period shall result in the Architect's decision becoming final and binding upon the Owner and Contractor. If the Architect renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence, but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.

§ 4.9.4.2 A demand for arbitration shall be made within the time limits specified in Sections 4.9.1 and 4.9.4 and Section 4.9.4.1 as applicable, and in other cases within a reasonable time after the Claim has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations as determined pursuant to Section 13.7.

§ 4.9.5 Limitation on Consolidation or Joinder. No arbitration arising out of or relating to the Contract Documents shall include, by consolidation or joinder or in any other manner, the Construction Manager, the Architect, or the Construction Manager's or Architect's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Construction Manager, Architect, Owner, Contractor and any other person or entity sought to be joined. No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Contractor, other Contractors as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in the arbitration. No persons or entities other than the Owner, Contractor or other Contractors as defined in Section 3.1.2 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a dispute not described therein or with a person or entity not named or described therein. The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 4.9.6 Claims and Timely Assertion of Claims. A party who files a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded. When a party fails to include a Claim through oversight, inadvertence or excusable neglect, or when a Claim has matured or been acquired subsequently, the arbitrator or arbitrators may permit amendment.

§ 4.9.7 Judgment on Final Award. The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

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

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

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Construction Manager for review by the Owner, Construction Manager and Architect the names of persons or entities (including those who are to furnish
materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Construction Manager will promptly reply to the Contractor in writing stating whether or not the Owner, Construction Manager or Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Construction Manager to reply promptly shall constitute notice of no reasonable objection.

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

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. The Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such change.

§ 5.3 SUBCONTRACTUAL RELATIONS
§ 5.3.1 By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement which may be at variance with the Contract Documents. Subcontractors shall similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS
§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner provided that:
   .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements which the Owner accepts by notifying the Subcontractor in writing; and
   .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

§ 5.4.2 If the Work has been suspended for more than 30 days, the Subcontractor’s compensation shall be equitably adjusted.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS
§ 6.1 OWNER’S RIGHT TO PERFORM CONSTRUCTION WITH OWN FORCES AND TO AWARD OTHER CONTRACTS
§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner’s own forces, which include persons or entities under separate contracts not administered by the Construction Manager. The Owner further reserves the right to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to those including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided elsewhere in the Contract Documents.
§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces including persons or
entities under separate contracts not administered by the Construction Manager, the Owner shall provide for
coordination of such forces with the Work of the Contractor, who shall cooperate with them.

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

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by
the Owner's own forces or other Contractors, the Contractor shall, prior to proceeding with that portion of the Work,
promptly report to the Construction Manager and Architect apparent discrepancies or defects in such other
construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to
report shall constitute an acknowledgment that the Owner's own forces or other Contractors' completed or partially
completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably
discoverable.

§ 6.2.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party
responsible therefor.

§ 6.2.4 The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed
construction or partially completed construction or to property of the Owner or other Contractors as provided in
Section 10.2.5.
§ 6.2.5 Claims and other disputes and matters in question between the Contractor and other Contractors shall be
subject to the provisions of Section 4.7 provided the other Contractors have reciprocal obligations.

§ 6.2.6 The Owner and other Contractors shall have the same responsibilities for cutting and patching as are
described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP
§ 6.3.1 If a dispute arises among the Contractor, other Contractors and the Owner as to the responsibility under their
respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish as
described in Section 3.15, the Owner may clean up and allocate the cost among those responsible as the
Construction Manager, in consultation with the Architect, determines to be just.

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

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

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and
Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive
or order for a minor change in the Work.
§ 7.1.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.2 CHANGE ORDERS
§ 7.2.1 A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect and Contractor, stating their agreement upon all of the following:
   .1 a change in the Work;
   .2 the amount of the adjustment in the Contract Sum, if any; and
   .3 the extent of the adjustment in the Contract Time, if any.

§ 7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Section 7.3.3.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES
§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

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

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:
   .1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
   .2 unit prices stated in the Contract Documents or subsequently agreed upon;
   .3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
   .4 as provided in Section 7.3.6.

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

§ 7.3.5 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.

§ 7.3.6 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 Construction Manager 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. In such case, and also under Section 7.3.3, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.6 shall be limited to the following:
   .1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers compensation insurance;
   .2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
   .3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.7 Pending final determination of cost to the Owner, amounts not in dispute may be included in Applications for Payment. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.8 If the Owner and Contractor do not agree with the adjustment in Contract Time or the method for determining it, the adjustment or the method shall be referred to the Construction Manager for determination.

§ 7.3.9 When the Owner and Contractor agree with the determination made by the Construction Manager concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately issued through the Construction Manager and shall be recorded by preparation and execution of an appropriate Change Order.

§ 7.4 MINOR CHANGES IN THE WORK
§ 7.4.1 The Architect will have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order issued through the Construction Manager and shall be binding on the Owner and Contractor. The Contractor shall carry out such written orders promptly.

ARTICLE 8 TIME
§ 8.1 DEFINITIONS
§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

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

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

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

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic’s liens and other security interests.

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

§ 8.3 DELAYS AND EXTENSIONS OF TIME
§ 8.3.1 If the Contractor is delayed at any time in progress of the Work by an act or neglect of the Owner’s own forces, Construction Manager, Architect, any of the other Contractors or an employee of any of them, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor’s control, or by delay authorized by the Owner pending arbitration, or by other causes which
the Architect, based on the recommendation of the Construction Manager, determines may justify delay, then the
Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Section 4.7.

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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

§ 9.2 SCHEDULE OF VALUES

§ 9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect, through the
Construction Manager, a schedule of values allocated to various portions of the Work, prepared in such form and
supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This
schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the
Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least fifteen days before the date established for each progress payment, the Contractor shall submit to the
Construction Manager an itemized Application for Payment for Work completed in accordance with the schedule of
values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's
right to payment as the Owner, Construction Manager or Architect may require, such as copies of requisitions from
Subcontractors and material suppliers, and reflecting retainage if provided for elsewhere in the Contract Documents.

§ 9.3.1.1 Such applications may include requests for payment on account of changes in the Work which have been
properly authorized by Construction Change Directives but not yet included in Change Orders.

§ 9.3.1.2 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to
a Subcontractor or material supplier because of a dispute or other reason.

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

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

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Construction Manager will assemble a Project Application for Payment by combining the Contractor's
applications with similar applications for progress payments from other Contractors and, after certifying the amounts
due on such applications, forward them to the Architect within seven days.

§ 9.4.2 Within seven days after the Architect's receipt of the Project Application for Payment, the Construction
Manager and Architect will either issue to the Owner a Project Certificate for Payment, with a copy to the
Contractor, for such amount as the Construction Manager and Architect determine is properly due, or notify the
Contractor and Owner in writing of the Construction Manager's and Architect's reasons for withholding
certification in whole or in part as provided in Section 9.5.1. Such notification will be forwarded to the Contractor by the Construction Manager.

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

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Construction Manager or Architect may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager’s or Architect’s opinion the representations to the Owner required by Section 9.4.3 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager or Architect will notify the Contractor and Owner as provided in Section 9.4.2. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Construction Manager and Architect will promptly issue a Certificate for Payment for the amount for which the Construction Manager and Architect are able to make such representations to the Owner. The Construction Manager or Architect may also decide not to certify payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager’s or Architect’s opinion to protect the Owner from loss because of:

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

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

§ 9.6 PROGRESS PAYMENTS

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

§ 9.6.2 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor’s portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor’s portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.
§ 9.6.3 The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

§ 9.6.4 Neither the Owner, Construction Manager nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Payment to material suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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

§ 9.7 FAILURE OF PAYMENT
§ 9.7.1 If, through no fault of the Contractor, 1) the Construction Manager and Architect do not issue a Project Certificate for Payment within fourteen days after the Construction Manager’s receipt of the Contractor’s Application for Payment or 2) the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Construction Manager and Architect or awarded by arbitration, then the Contractor may, upon seven additional days’ written notice to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor’s reasonable costs of shut-down, delay and start-up, which shall be accomplished as provided in Article 7.

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

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof of which the Owner agrees to accept separately, is substantially complete, the Contractor and Construction Manager shall jointly prepare and submit to the Architect a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect’s inspection discloses any item, whether or not included on the list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. The Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

§ 9.8.3 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Construction Manager and Architect, the Owner shall make payment, reflecting adjustment in retumage, if any, for such Work or portion thereof as provided in the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE
§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.11 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments,
retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing
centering the period for correction of the Work and commencement of warranties required by the Contract
Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction
Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the
Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work
shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by
decision of the Architect after consultation with the Construction Manager.

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

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

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT
§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a written notice
that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final
Contractor’s Application for Payment. Upon receipt, the Construction Manager will forward the notice and
Application to the Architect who will promptly make such inspection. When the Architect, based on the
recommendation of the Construction Manager, finds the Work acceptable under the Contract Documents and the
Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for
Payment stating that to the best of their knowledge, information and belief, and on the basis of their observations
and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents
and that the entire balance found to be due the Contractor and noted in said final Certificate is due and payable. The
Construction Manager’s and Architect’s final Certificate for Payment will constitute a further representation that
conditions listed in Section 9.10.2 as precedent to the Contractor’s being entitled to final payment have been
fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits
to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment,
and other indebtedness connected with the Work for which the Owner or the Owner’s property might be responsible
or encumbered (less amounts withheld by Owner) have been paid or other wise satisfied, (2) 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, (3)
a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to
cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if
required by the 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 Subcontractor refuses to furnish a release or waiver required by the
Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. 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.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault
of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and
Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction
Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of
the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less
than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety
to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the
Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment
shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of
Claims. The making of final payment shall constitute a waiver of Claims by the Owner as provided in Section 4.4.5.
§ 9.10.4 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Such waivers shall be in addition to the waiver described in Section 4.7.5.

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 performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors.

§ 10.1.2 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner, Construction Manager and Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless, by written agreement of the Owner and Contractor, or in accordance with final determination by the Architect on which arbitration has not been demanded, or by arbitration under Article 4.

§ 10.1.3 The Contractor shall not be required pursuant to Article 7 to perform without consent any Work relating to asbestos or polychlorinated biphenyl (PCB).

§ 10.1.4 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Construction Manager, Architect, their consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Owner, anyone directly or indirectly employed by the Owner or anyone for whose acts the Owner may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 10.1.4.

§ 10.1.5 If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, Construction Manager and Architect in writing. The Owner, Contractor, Construction Manager and Architect shall then proceed in the same manner described in Section 10.1.2.

§ 10.1.6 The Owner shall be responsible for obtaining the services of a licensed laboratory to verify a presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection.

§ 10.2 SAFETY OF PERSONS AND PROPERTY
§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

 employees on the Work and other persons who may be affected thereby;
the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors;

other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction; and

construction or operations by the Owner or other Contractors.

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

§ 10.2.3 The Contractor shall 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.

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

§ 10.2.7 The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

§ 10.3 EMERGENCIES
§ 10.3.1 In an emergency affecting safety or persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Section 4.7 and Article 7.

ARTICLE 11 INSURANCE AND BONDS
§ 11.1 CONTRACTOR'S LIABILITY INSURANCE
§ 11.1.1 The Contractor shall purchase and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 claims under workers compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;

.2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 claims for damages insured by usual personal injury liability coverage which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person;
5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and
7 claims involving contractual liability insurance applicable to the Contractor’s obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days’ prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, an additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Section 9.10.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor’s information and belief.

§ 11.2 OWNER’S LIABILITY INSURANCE
§ 11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner’s usual liability insurance. Optionally, the Owner may purchase and maintain other insurance for self-protection against claims which may arise from operations under the Contract. The Contractor shall not be responsible for purchasing and maintaining this optional Owner’s liability insurance unless specifically required by the Contract Documents.

§ 11.3 PROPERTY INSURANCE
§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance in the amount of the initial Contract Sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 5.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is earlier. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Work.

§ 11.3.1.1 Property insurance shall be on an “all-risk” policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, falsework, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect’s services and expenses required as a result of such insured loss. Coverage for other perils shall not be required unless otherwise provided in the Contract Documents.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance which will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires minimum deductibles and such deductibles are identified in the Contract Documents, the Contractor shall pay costs not covered because of such deductibles. If the Owner or insurer increases the required minimum deductibles above the amounts so identified or if the Owner elects to purchase this
insurance with voluntary deductible amounts, the Owner shall be responsible for payment of the additional costs not covered because of such increased or voluntary deductibles.

§ 11.3.1.4 Unless otherwise provided in the Contract Documents, this property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

§ 11.3.1.5 The insurance required by this Section 11.3 is not intended to cover machinery, tools or equipment owned or rented by the Contractor which are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor’s own expense, provide insurance coverage for owned or rented machinery, tools or equipment which shall be subject to the provisions of Section 11.3.7.

§ 11.3.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance. The Owner, at the Owner’s option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner’s property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner’s property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or for other 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.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other perils covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least 30 days’ prior written notice has been given to the Contractor.

§ 11.3.7 Waivers of Subrogation. The Owner and Contractor waive all rights against each other and against the Construction Manager, Architect, Owner’s other Contractors and own forces described in Article 6, if any, and the subcontractors, sub-subcontractors, consultants, agents and employees of any of them, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Construction Manager, Construction Manager’s consultants, Architect, Architect’s consultants, Owner’s separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under Owner’s property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgage clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of
insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner’s duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or in accordance with an arbitration award in which case the procedure shall be as provided in Section 4.9. If after such loss no other special agreement is made, replacement of damaged property shall be covered by appropriate Change Order.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner’s exercise of this power; if such objection be made, arbitrators shall be chosen as provided in Section 4.9. The Owner as fiduciary shall, in that case, make settlement with insurers in accordance with directions of such arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.

§ 11.3.11 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND
§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK
§ 12.1 UNCOVERING OF WORK
§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager’s or Architect’s request or to requirements specifically expressed in the Contract Documents, it must, if required in writing by either, be uncovered for their observation and be replaced at the Contractor’s expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK
§ 12.2.1 The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing and inspections and compensation for the Construction Manager’s and Architect’s services and expenses made necessary thereby.

§ 12.2.2 If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of one year shall be extended with respect to portions of Work first performed after Substantial
Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation under this Section 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

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

§ 12.2.4 If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Section 2.4. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect issued through the Construction Manager, the Owner may remove it and store the salvable materials or equipment at the Contractor’s expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice, the Owner may upon ten additional days’ written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Construction Manager’s and Architect’s services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

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

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

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

ARTICLE 13 MISCELLANEOUS PROVISIONS
§ 13.1 GOVERNING LAW
§ 13.1.1 The Contract shall be governed by the law of the place where the Project is located.

§ 13.2 SUCCESSORS AND ASSIGNS
§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. 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.

§ 13.3 WRITTEN NOTICE
§ 13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

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

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

§ 13.5 TESTS AND INSPECTIONS
§ 13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so the Construction Manager and Architect may observe such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

§ 13.5.2 If the Construction Manager, Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so the Construction Manager and Architect may observe such procedures. The Owner shall bear such costs except as provided in Section 13.5.3.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager’s and Architect’s services and expenses.

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

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

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

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

§ 13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD
§ 13.7.1 As between the Owner and Contractor:
  .1 Before Substantial Completion. As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
  .2 Between Substantial Completion and Final Certificate for Payment. As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and
  .3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to
run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Section 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Section 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

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

1. Issuance of an order of a court or other public authority having jurisdiction;
2. An act of government, such as a declaration of national emergency, making material unavailable;
3. Because the Construction Manager or Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.2, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents;
4. If repeated suspensions, delays or interruptions by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less; or
5. The Owner has failed to furnish to the Contractor promptly, upon the Contractor’s request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 If one of the above reasons exists, the Contractor may, upon seven additional days’ written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages.

§ 14.1.3 If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner’s obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days’ written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.2.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor:

1. Persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
2. Fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
3. Persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
4. Otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, after consultation with the Construction Manager, and 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 the Contractor’s surety, if any, seven days’ written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

1. Take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
2. Accept assignment of subcontracts pursuant to Section 5.4; and
3. Finish the Work by whatever reasonable method the Owner may deem expedient.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.
§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Architect after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

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

§ 14.3.2 An adjustment shall be made for increases in the cost of performance of the Contract, including profit on the increased cost of performance, caused by suspension, delay or interruption. 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 this Contract.

§ 14.3.3 Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee.
SECTION 00800 - SUPPLEMENTARY GENERAL CONDITIONS

The following supplement modifies or changes the General Conditions of the Contract - AIA Document A201/CMA - 1992 Edition, Electronic Format. Where any portion of the General Conditions are addressed in these Supplementary Conditions, the unaltered provisions shall remain in effect as part of the Contract Requirements.

ARTICLE 1 GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

Add the following new Subparagraph 1.1.8 to Paragraph 1.1:

1.1.8 MISCELLANEOUS DEFINITIONS

1.1.8.1 The term “product” as used throughout the Contract Documents includes materials, systems, and equipment.

1.1.8.2 The term “furnish” as used throughout the Contract Documents means supply and deliver, ready to install.

1.1.8.3 The term “install” as used throughout the Contract Documents means position for service or use.

1.1.8.4 The term “provide” as used throughout the Contract Documents means furnish and install, ready for use.

1.1.8.5 The term “Architect” may mean Professional Engineer, if such is identified in the Contract as the one responsible for administrating the Contract. The abbreviation “A/E” in the Project Manual means Architect or Professional Engineer who is administering the Contract.

1.1.8.6 The term “Public Agency” as used throughout the Contract Documents means:

.1 the Commonwealth/State and its departments, boards, commissions, and agencies;
.2 counties, cities, boroughs, townships, school districts, and any other governmental unit or district;
.3 the State Public School Building Authority, the State Highway and Bridge Authority, and any other authority now in existence or hereafter created or organized by any county, city, borough, township, or school district, or combination thereof; and
.4 any and all other public bodies, authorities, officers, agencies, or instrumentalities, whether exercising a governmental or proprietary function.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add Clause 1.2.1.1 to Subparagraph 1.2.1

1.2.1.1 In the event of conflicts or discrepancies among the Contract Documents, interpretation will be based on the following priorities:

1. The Agreement
2. Addenda, with those of later date having precedence over those of earlier date.
3. These Supplementary Conditions.
4. The General Conditions of the Contract.
5. Division 1 of the Specifications.
6. Drawings and Division 2 - 17 of the Specifications.

In the case of conflict or discrepancy between Drawings and Division 2-17 of the specifications or within either Document not clarified by Addendum, the Architect will determine which takes precedence in accordance with Subparagraph 4.2.11.

1.6 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

Add the following new Subparagraphs to Paragraph 1.6:

1.6.2 Contractor’s Use of Instruments of Service in Electronic Form

1.6.2.1 The Architect may, with the concurrency of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form as indicated in paragraph 1.6.3.1 below. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1, (Hard copy drawings), shall prevail in case of any inconsistency with subsequent versions made through mutable electronic means involving computers.

1.6.2.2 The Contractor shall not transfer or reuse Instruments of Service in electronic or machine readable form without the express and prior written consent of the Architect.

1.6.2.3 The Contractor shall keep secured at the site a minimum of one copy of the Contract, Addenda, Drawings, Project Manual, and Modifications.

1.6.3 Instruments of Service in Electronic Form available to the Contractor

1.6.3.1 Electronic format CAD drawing files on CD-ROM, or similar non-mutable medium of Site Plans, Floor Plans and Reflected Ceiling Plans are available for purchase by Prime Contractors from the Architect, for site and building layout, and shop drawing layout backgrounds. The Mechanical, Electrical, and Plumbing Drawings ARE NOT available. All drawings shall be in the electronic format used by the Architect at the time of purchase. The purchase price is dependant upon the size and complexity of the project.

ARTICLE 2 OWNER

2.1 GENERAL

Delete Subparagraph 2.1.2 in its entirety.

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

Delete Subparagraph 2.2.5 in its entirety and substitute new Subparagraph 2.2.5 as follows:

2.2.5 The Contractors will be furnished, free of charge, copies of Contract Drawings and Project Manuals as follows:
.1 General Contractor; (1) one disk of Drawings and Project Manual.
.2 Mechanical, Plumbing and Electrical Contractors; (1), disk of Drawings and Project Manual; if multiple prime bid.
.3 Additional sets can be furnished to Prime Contractors from the Construction Manager at the cost of reproduction, postage, and handling.

ARTICLE 3 CONTRACTOR

3.1 GENERAL

Add the following new Clause to Subparagraph 3.1.1.

3.1.1.1 The Project Manual phrase, “Contractor” in multiple prime construction work means each Contractor who has a contract with the Owner to perform Work.

3.18 INDEMNIFICATION

Add the following sentence at the end of Subparagraph 3.18.1:

Similarly, the Contractor shall indemnify and hold harmless the same parties and in the same manner from all fines, penalties, or other similar losses incurred as the result of the indemnifying parties' violation of any law, ordinance, rule or other regulation of any duly constituted public authority or body.

Add the following new Subparagraph 3.18.3:

3.18.3 In claims against any person or entity indemnified under subparagraph 3.18.1, above, by an employee of the Contractor, a subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, these aforesaid and listed contractor entities for themselves and their successors and assigns hereby expressly waive any provision of the applicable state's workers compensation act whereby any of the aforesaid and listed contractor entities could preclude joinder as an additional or third party defendant or in any way avoid liability for damages, contribution, or indemnity in any action at law or otherwise by an indemnified party.

ARTICLE 4 ADMINISTRATION OF THE CONTRACT

Add to paragraph 4.4.5 “if arbitration is elected by the Owner as set forth in this Article.”

Add to paragraph 4.4.6: “if arbitration is elected by the Owner as set forth in this Article.”

Delete subparagraph 4.6.1

Delete subparagraph 4.6.2

Add the following new paragraph:

4.6.0 All claims, disputes, and other matters in question between the Contractor and the Owner arising out of or relating to this Agreement, the Project, the Work, the Contract Documents or the breach thereof may, at the Owner’s sole option, and only upon the exercise of that sole option by the Owner, be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. The Contractor may not unilaterally elect
arbitration or cause arbitration to occur. The Owner has the sole discretion to decide whether or not any such claims, disputes or other matters shall be submitted for arbitration."

Add the following new paragraph:

4.7 AMERICAN ARBITRATION ASSOCIATION (AAA) MEDIATION AND ARBITRATION LOGISTICS

4.7.1 Mediation shall not begin unless representatives of the mediation claimant and mediation respondent are either the principals themselves or authorized in writing by their principals to settle the matter. Such written authorization shall be presented to the mediator.

4.7.2 Arbitration shall be heard and decided by one arbitrator with at least 15 years of construction industry experience if the claim is less than $250,000.00. If the total exceeds that amount, the claim shall be heard and decided by three such arbitrators.

4.7.2.2 Proceed if evidence to be presented during arbitration has been shared with the opposition a minimum of 14 days prior to the arbitration hearing.

ARTICLE 7 CHANGES IN THE WORK

7.2 CHANGE ORDERS

Delete Subparagraph 7.2.2 and add the following new Subparagraph 7.2.2:

7.2.2 Methods used in determining adjustments to the Contract Sum shall include those listed in Paragraph 7.3.

7.3 CONSTRUCTION CHANGE DIRECTIVES

Subparagraph 7.3.6: In the first sentence, delete the words “a reasonable allowance for overhead and profit” and substitute “an allowance for overhead and profit in accordance with the paragraph below”.

Add the following new Subparagraphs 7.3.10 and 7.3.11 to Paragraph 7.3:

7.3.10 In Subparagraph 7.3.6, the allowance for overhead and profit included in the total cost to the Owner, shall be based on the following schedule:

1. For the Contractor, for any Work performed by the Contractor’s own forces, 10% of the cost.
2. For the Contractor, for any Work performed by their Subcontractor, 5% of the amount due the Subcontractor.
3. For each Subcontractor or Sub-subcontractor involved, for any Work performed by that Contractor’s own forces, 10% of the cost.
4. For each Subcontractor, for any Work performed by their Sub-subcontractor 5% of the amount due the Sub-subcontractor.
5. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

7.3.11 Construction Change Directive Back-Up: In order to facilitate checking of quotations for extras or credits, all proposals shall be accompanied by a complete itemization of costs including
labor, material, Subcontractor, or vendor invoices. Labor and materials shall be itemized in the manner prescribed above. Where items are Subcontracts, they shall be likewise itemized.

ARTICLE 8  TIME

8.3 DELAYS AND EXTENSIONS OF TIME

Delete Subparagraph 8.3.3 and substitute the following:

8.3.3 A time extension pursuant to Subparagraph 8.3.1 shall be the Contractor’s sole and exclusive remedy for delays caused by the Owner or Architect, or an employee of either; labor disputes; fire; unusual delay in deliveries; unavoidable casualties; or other causes beyond the Contractor’s control, or by delay authorized by the Owner pending mediation or arbitration; or by other causes which the Architect determines may justify delay. In the event of delay caused by a separate contractor employed by the Owner, the Contractor’s sole and exclusive remedy for that delay is against the delaying separate contractor and not against the Owner or Architect, or an employee of either.

ARTICLE 11  INSURANCE AND BONDS

11.1 CONTRACTOR’S LIABILITY INSURANCE

Add the following new Clause to Subparagraph 11.1.2:

11.1.2.1 The insurance required by Subparagraph 11.1.1 shall be written for not less than the following, or greater if required by law:

1. Workers’ Compensation:
   (a) State: Pennsylvania Statutory
   (b) Applicable Federal (e.g., Longshoremen, Harbor Work, Work at or outside U.S. Boundaries): Statutory
   (c) Employer’s Liability: Statutory
   (d) Benefits Required by Union labor contracts: As applicable.

2. General Liability
   (a) General Aggregate $2,000,000
   (b) Products & Completed Operations Aggregate $2,000,000
   (c) Personal & Advertising Injury $1,000,000
   (d) Each Occurrence $1,000,000

3. Excess Liability $2,000,000

4. Business Automobile Liability $1,000,000 Per Accident

Add the following new Clause 11.1.3.1 to Subparagraph 11.1.3:

11.1.3.1 Furnish one copy of Certificate of Insurance herein required with each copy of the Agreement. Certificate shall specifically set forth evidence of all coverage required by 11.1.1 and 11.1.2. The form of the certificate shall be the Industry Standard, Accord Certificate of Insurance
form with AIA Document G715, Supplemental attachment for Accord Certificate of Insurance Section 00620 executed and attached to the Agreement. Furnish the Owner with copies of any endorsements that are subsequently issued amending coverage or limits. Delete ("x" or strike out) cancellation "will endeavor to notify" statement at bottom of Certificate and type the following statement at the bottom of the certificate: The insurer shall notify the Owner in writing of any insurance revisions or the pending cancellation or expiration of any policy or policies listed 30 calendar days prior to the occurrence. The insurer's notification shall be by certified mail and a return receipt shall be requested per U.S. Postal Service Regulations.

11.1.4 The Contractor shall name as Additional Insured, on all insurance policies, the following:

1. Harrisburg Area Community College
2. Eastern pcm, LLC
3. Johnson, Mirmiran, Thompson

Add the following new Article 15:

ARTICLE 15 - LAWS, REGULATIONS, CODES, ACTS, etc.

15.1 GOVERNING LAWS AND REGULATIONS

15.1.1 All applicable Federal and State Laws, Municipal Ordinances and Codes, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Contract throughout, and they are deemed to be included in the Contract the same as though printed herein in full.

15.2 FEDERAL OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970 (O.S.H.A)

15.2.1 Attention is directed to the terms, provision, and conditions of the William-Steiger Safety and Health Act of 1970, which is specifically applicable to this project. The Contractor agrees to be bound by them and further agrees and promises to conform and comply with the Standards set forth in the Act.

15.2.2 The Contractor is required to promptly perform all reporting and recording, compliance, and safety as required by said Act.

15.3 SALES TAX STATUS UNDER ACT 45 FOR PUBLIC CONSTRUCTION PROJECTS

15.3.1 The Owner, Harrisburg Area Community College, alone is entitled to receive all sales tax refunds resulting from any "Tax-Excluded Status", and the Contractor, as a contingency of entering into a contract with Harrisburg Area Community College, must agree to expressly assign to Harrisburg Area Community College the sole right and authority to claim and receive refund payments for sales taxes resulting out of this project.

15.4 DISCRIMINATION PROHIBITED

15.4.1 According to 62 Pa.C.S.A. § 3701, the Contractor agrees that:

In hiring of employees for the performance of work under the contract or any subcontract, no contractor, subcontractor, or any person acting on behalf of the contractor or
subcontractor shall by reason of gender, race, creed, or color discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates. No contractor or subcontractor or any person on his or her behalf shall in any manner discriminate against or intimidate any employee hired for the performance of work under the contract on account of gender, race, creed, or color. The contract may be cancelled or terminated by the government agency and all money due or to become due under the contract may be forfeited for a violation of the terms or conditions of that portion of the contract.

15.4.2 HUMAN RELATIONS ACT: According The provisions of the Pennsylvania Human Relations Act, Act 222 of October 27, 1955 (P.L. 744) (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 this Act as amended that are made part of this specification. Your attention is directed to the language of the Commonwealth's non-discrimination clause in 16 PA. Code 49.101.

15.5 PENNSYLVANIA PREVAILING WAGE RATES

15.5.1 This regulation and the general Pennsylvania prevailing minimum wage rates, (Act 442 of 1961, P.L. 987, amended), as determined by the Secretary of Labor and Industry, which shall be paid for each craft or classification of all workers needed to perform the contract during the anticipated term therefore in the locality in which public work is performed, are made part of this specification.

15.6 PROVISIONS FOR THE USE OF STEEL AND STEEL PRODUCTS

15.6.1 In accordance with Act 3 of the 1978 General Assembly of the Commonwealth of Pennsylvania, if any steel or steel products are to be used or supplied in the performance of the Contract, only those produced in the United States as defined in 73 Pa. Stat. Section 1886 shall be used or supplied in the performance of the Contract and in any subcontracts thereunder as mandated by 73 Pa. Stat. Section 1884.

15.6.2 Steel products have been defined in 73 Pa. Stat. Section 1886 as products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more of such operations, from steel made in the United States by the open hearth, basic oxygen, electric furnace, Bessemer or other steel making process and shall include cast iron products and shall include machinery and equipment listed in United States Department of Commerce Standard Industrial Classification 25 (furniture and fixture), 35 (machinery, except electrical) and 37 (transportation equipment) and made of, fabricated from, or containing steel components. If a product contains both foreign and United States steel, such product shall be determined to be a United States steel product only if at least 75% of the cost of the articles, materials and supplies have been mined, produced or manufactured, as the case may be, in the United States.

15.6.3 In accordance with Act 161 of 1982, cast iron products shall also be included and produced in the United States. Act 141 of 1984 further defines "steel products" to include machinery and equipment. The act also provided clarifications and penalties.
15.7 NO DRUGS OR ALCOHOLIC BEVERAGES ON-SITE

15.8.1 Any person discovered on-site with/or under the influence of any illegal drugs or alcoholic beverages shall be told by the Contractor to leave the site, that person shall not return, and shall be prosecuted by law. Each Contractor shall be responsible to monitor and enforce this issue with his own employees and subcontractors.

15.8 NO WEAPONS ON-SITE

15.9.1 Any person discovered on-site possessing a weapon shall be required to leave the site immediately. That person shall not be permitted to return, and shall be prosecuted by law, as appropriate. Each Contractor shall be responsible to monitor and enforce this issue with his own employees and subcontractors.

END OF SECTION 00800
SECTION 00820 – PREVAILING WAGE RATES

The referenced project is subject to the Pennsylvania Department of Labor and Industry Prevailing Wage Rates.

The attached Prevailing Minimum Wage Rate Determination has been issued by The Pennsylvania Department of Labor & Industry, Prevailing Wage Division, 1301 Labor and Industry Building, Harrisburg, PA 17120 for this project:

<table>
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<th>Project Name:</th>
<th>Repairs to Evans Gym Pools</th>
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<td>Awarding Authority/Agency:</td>
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<td>These Rates are Applicable to:</td>
<td>Pool Repairs</td>
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The Prevailing Wage Rates are the most recent rates posted at the time of issue of the Project Manual. The Architect is not responsible for rate clarifications and/or rate distinctions. Prevailing Wage Rates are available through internet access. Contractors are encouraged to stay abreast of the most current rates before submitting bids.

END OF SECTION 00820
# PREVAILING WAGES PROJECT RATES

**Project Name:** Repairs to Evans Gym Pools  
**Awarding Agency:** Harrisburg Area Community College  
**Contract Award Date:** 3/3/2010  
**Serial Number:** 10-00100  
**Project Classification:** Building  
**Determination Date:** 1/7/2010  
**Assigned Field Office:** Harrisburg  
**Field Office Phone Number:** 717-787-4763  
**Toll Free Phone Number:** 800-932-0665

## Dauphin County

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## PREVAILING WAGES PROJECT RATES

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## PREVAILING WAGES PROJECT RATES

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SECTION 01125 - SUMMARY of CONTRACT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes a summary of each contract, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements of each contract are also indicated in individual Specification Sections and on Drawings.

C. Related Sections include the following:

1. Division 1 Section "Summary" for the Work covered by the Contract Documents, restrictions on use of the premises, Owner-occupancy requirements, and work restrictions.
2. Division 1 Section "Project Management and Coordination" for general coordination requirements.
3. Division 1 Section "Temporary Facilities and Controls" for specific requirements for temporary facilities and controls.

1.3 DESCRIPTION OF CONTRACT

A. The work of this project shall be performed under a Single Prime Contract and consists of removal and replacement of the ceramic tile in the training pool, diving tank, and the pool decks; ramp and railing modifications for ADA compliance; modifications to the pool drain systems for compliance with the Virginia Graeme Baker Act; installation of a new vacuum system in the training pool and diving tank; removal and replacement of the rooftop mounted Desert Aire HVAC system, including all electric, plumbing, roofing, and controls for a complete installation; modifications to the existing balance tank and installation of an automated pool water level management system, including the removal of the existing fill tank and associated piping. Electrical work will include, but not be limited to, installation of new circuitry for the rooftop mounted HVAC systems, installation of new electrical panels and branch circuitry.

B. The General Conditions, Supplementary Conditions and Division 1 - General Requirements shall apply to all Prime and/or Subcontracts.

C. The Contractor shall supervise their own Work, using their best skills and attention and shall be solely responsible for construction means, methods, techniques, sequences, dimensions and procedures and/or coordinating all portions of the Work.
D. The Contractor shall provide all items of work listed under the Contract unless specifically noted as furnished or installed only.

E. The Contractor shall maintain and coordinate the Construction schedule as required.

F. The Contractor shall be responsible for securing all permits required by their work. Owner will obtain a general building permit through the Construction Manager.

G. The Contractor shall be responsible for any and all utility tap-in fees. Required for the work of their contract.

H. The Contractor responsible for the installation of materials shall also be responsible for providing all testing services required for the work indicated in the technical specifications, Division 2 though 17.

I. If the applicable Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any work to specifically be tested, inspected, or approved by someone other than the installing Contractor, such Contractor shall give the Owner and their Representative timely notice of readiness. The Contractor will then furnish the Owner the required certificates of inspection, testing or approval.

J. Inspection, tests, or approvals by the Owner or their Representative shall not relieve the Contractor from their obligation to perform the work in accordance with the requirements of the Contract Documents.

K. The Contractor shall be responsible to maintain all staging, storage and work areas in clean and orderly condition.

L. The Contractor shall provide for all temporary enclosures of building openings as required to maintain the schedule of the project.

M. Definitions:

Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weather tight; exterior walls are insulated and weather tight; and all openings are closed with permanent construction or substantial temporary closures.

Coordinate: The term "coordinate" means "to cooperate with related contractors to furnish and install all connections between the work of separate contractors in correct sequence, size and location to create a complete system ready for intended use."

Verify: The term "verify" means "to measure, investigate, review, test, check the accuracy or correctness of and prove by demonstration, evidence, or testimony the location, size, dimension and condition of an item."
Furnish: The term "furnish" is used to mean "supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar operations."

Install: The term "install" is used to describe operations at the project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, performing, coordinating with other trades, protecting, cleaning, and similar activities".

Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."

1.3 COORDINATION

A. Project Coordination shall be the responsibility of the Single Prime Contractor.

1.4 PROJECT COORDINATOR – (NOT USED)

1.5 GENERAL REQUIREMENTS OF CONTRACTS

A. Extent of Contract: Unless the Agreement contains a more specific description of the Work, names and terminology on Drawings and in Specification Sections determine which contract includes a specific element of Project.

B. The following items are considered to be part of the contractor's responsibility. Each bidder should fully review the responsibilities of each contract to ensure a complete understanding of the limits and scopes of work for each.

1. Local custom and trade-union jurisdictional settlements do not control the scope of the Work of each contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, affected contractors shall negotiate a reasonable settlement to avoid or minimize interruption and delays.

2. Coordinate their work with the work of other Prime Contractors.

3. Provide all fees, Federal, State and Local taxes, special permits, inspections, etc. as required to perform the work of the Prime Contract unless this item is specifically identified as being provided by the Owner.

4. Provide safety and protection of persons and property per OSHA, local and state requirements. Provide maintenance of all safety precautions throughout the work of this Contract. Provide protection at floor and roof penetrations not shown on the drawings, but required for work of this Contract. Provide all safety signage required by OSHA for the work of this Contract. Furnish Company Safety Plan, Hazard Communication Plan, MSDS information and other OSHA required documents to the General Contractor and Owner's designated representative prior to the start of work.

5. Submit shop drawings, samples, schedules, data, manuals, as-built drawings, etc., required by the Contract Documents. Update, on a weekly basis, a record set cf drawings in the field office.
6. Provide all stakes, templates and labor required in laying out their work and be responsible for proper execution of the work to the lines and grades shown on the drawings and as indicated by the Architect and / or Engineer.
7. Verify existing conditions prior to start of work and be responsible for notifying Architect of any discrepancies found in field prior to starting work.
8. Provide protection of existing structure, finishes and landscaping from damage resulting from the work of their contract. Repair any damage promptly to the satisfaction of the Owner.
9. Clean construction vehicle wheels to keep paved surfaces free and clear of mud and debris.
10. Provide Disposal of all hazardous materials in accordance with Federal, State, County and Local requirements. No hazardous materials shall be placed in the General Contractor’s, Owner’s or other parties waste containers or dumpster.
11. Provide all scaffolding, hoisting, shoring, barricades, ramps, etc., as necessary to perform the work of their contract.
12. Provide all dewatering required to perform the work of their contract.
13. Provide all utility trenching for work required by their contract. Note that the General Contractor is responsible for all utility work outside of 5'-0" from the face of the building.
15. Through-penetration fire stopping for the Work of each contract shall be provided by each contract for its own Work.
16. Access panels required for the work of each contract shall be provided by each Contract for its own work.

C. Temporary Facilities and Controls. In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Division 1 Section "Temporary Facilities and Controls," each contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, and costs and use charges associated with each facility.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.
3. Its own field office, complete with necessary furniture, utilities, and telephone service.
4. Its own storage and fabrication sheds.
5. Temporary enclosures for its own construction activities.
6. General hoisting facilities for its own construction activities, up to 4 tons.
7. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
8. Progress cleaning of its own areas on a daily basis.
9. Secure lockup of its own tools, materials, and equipment.
10. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.
1.6 CONTRACTS (NOT USED)

1.7 PRODUCTS (Not Used)

PART 2 - EXECUTION (Not Used)

END OF SECTION 01125
SECTION 01230 – ALTERNATES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form 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 Base Bid to incorporate the selected alternate into the Work. No other adjustments are made to the Base Bid.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate 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, notify each party involved, in writing, of the status of each alternate. Indicate if 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 the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve work described under each alternate.

PART 2 – PRODUCTS – Not Applicable
PART 3 – EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. **Alternate Number 1 – Painting/Special Coatings**: Submit cost to patch and prepare walls, ceilings and portions of the floor. Additionally provide cost for painting and coating walls as indicated on Drawings A101 and A102. Refer to Section 09910 and 09960.

B. **Alternate Number 2 – Masonry Control Joints**: Submit cost to provide interior masonry control joints for the Pool Room walls as shown on Drawing A104 and specification Section 07920.

C. **Alternate Number 3 – Acoustical Panels**: Submit cost to demolish existing wall mounted acoustical panels and mounting devices. In addition submit cost to provide wall and ceiling mounted acoustical ceiling panels as shown on Drawing A103.

D. **Alternate Number 4 – Benches**: Submit cost to remove existing Pool Room benches, strip finish and to provide a new urethane finish. Refer to Drawings A101 and A102 and specification Section 09910.

E. **Alternate Number 5 – Exterior Door**: Submit cost to provide new exterior door and ladder in Electric Penthouse. Refer to Drawing A104 and specification Sections 08100 and 08700.

F. **Alternate Number 6 – Automated Pool Management System**: Submit cost to provide an integrated microprocessor-based electronic water treatment control system including all specified functions and accessories.

G. **Alternate Number 7 – Pool Area Lighting**: Submit cost to provide new lighting in the pool area. Refer to Drawing E-601 and specification section 16511.

H. **Alternate Number 8 - Door Hardware**: Submit cost to demolish latchsets/locksets and provide new panic bar hardware for doors indicated on Drawings A101 and A102. Refer to Section 08100.

END SECTION 01230
SECTION 01250 – CONTRACT MODIFICATION PROCEDURES

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 specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. The Architect will issue supplemental instructions directing or authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by the Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within 20 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to the owner through the Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.


D. Contractor proposals shall be evaluated for inclusion into a Change Order if the proposals:
   1. Provide an adequately detailed breakdown of labor and material costs.
   2. Are related to the Schedule of Values cost-wise.
   3. If the labor and material costs proposed are comparable to documentable industry costs in the area of the Work.
   4. Include signed copies of subcontractor proposals as attachments.
   5. Include original factory or material distributor quotations for materials.
   6. Show overhead and profit as an all-inclusive multiplier (overhead and profit includes labor multiplier, bond increases, field and home office project management costs and any other industry standard costs associated with change order work).

1.5 CHANGE ORDER PROCEDURES


1.6 CONSTRUCTION CHANGE DIRECTIVE

   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed daily records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
2. Inclusion of Construction Change Directive work into a change order shall be on the basis of the evaluation requirements specified herein.

3. The value of the Construction Change Directive or Change Order shall be based on the contractor's direct cost to perform the work plus an allowance for overhead & profit in accordance with the following schedule:
   a. For the Contractor, for any Work performed by the Contractor's own forces, 10% of the cost.
   b. For the Contractor, for any Work performed by their Subcontractor, 5% of the amount due the Subcontractor.
   c. For each Subcontractor or Sub-subcontractor involved, for any Work performed by that Contractor's own forces, 10% of the cost.
   d. For each Subcontractor, for any Work performed by their Sub-subcontractor 5% of the amount due the Sub-subcontractor.
   e. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250
SECTION 01290 – PAYMENT PROCEDURES

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 specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment

1.4 SCHEDULE OF VALUES

A. Purpose: To provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.

B. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.

C. Scope:

1. The Contractor shall prepare two separate but related schedules of value:

   a. Schedule of Values - Labor and Material; generally a one-time submission.
   b. Schedule of Values - Continuation Sheet (page two of AIA Application and Certificate of Payment, AIA Document G703) submitted with each monthly Pay Application.
1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid by Owner.

   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The Work progress date for each progress payment is the 25th day of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends the 25th of the month.

C. Retainage: All Payment Applications, except for the Substantial Completion Application, shall provide for an amount to be retained by the Owner of ten percent (10%) of the amount applied for during the defined payment period.

   Retainage will be released in accordance with Paragraph 5.7.1 of the Contract Between Owner and the Contractor, AIA – A101/CMa.

D. Payment Application Forms: Use AIA Document G702/CMa and AIA Document G703 Continuation Sheets as form for Applications for Payment. Samples of these forms are included in this specification section for your use.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. The Construction Manager will return incomplete applications without action.

   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to the Construction Manager by a method ensuring receipt within 24 hours.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

   1. Schedule of Values - Continuation Sheet.
   2. Schedule of Values- Labor and Materials.
   5. Initial progress report.
   6. Certificates of insurance and insurance policies.
   7. Performance and payment bonds, if required.
   8. Data needed to acquire Owner's insurance.
   9. Initial settlement survey and damage report if required.

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment to the Construction
Manager showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment to the Construction Manager with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.

J. Final Payment Application: Submit final Application for Payment to the Construction Manager with releases and supporting documentation not previously submitted and accepted, including, but not limited to, the following:

1. Evidence of completion of Project closeout requirements
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, “Contractors Affidavit of Payment of Debts and Claims”
6. AIA Document G707, “Consent of Surety to Final Payment”
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

Samples of forms G706, G706A, and G707 are included in this specification section for your use.

1.6 Samples of the following forms are bound at the end of this section for your use:
1. G702/CMa – Application and Certificate for Payment
2. G703 – Continuation Sheet
3. G706 – Contractor’s Affidavit of Payment of Debts and Claims
4. G706A – Contractor’s Affidavit of Release of Liens
5. G707 – Consent of Surety to Final Payment

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290
Application and Certificate for Payment Construction Manager-Adviser Edition

TO OWNER: PROJECT: Sample

FROM CONTRACTOR: VIA CONSTRUCTION MANAGER:
CONTRACT FOR: General Construction VIA ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT
Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM........................................... $ 0.00
2. Net change by Change Orders .................................. $ 0.00
3. CONTRACT SUM TO DATE (Line 1 + 2)........................ $ 0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) $ 0.00

5. RETAINAGE:
   a. 0 % of Completed Work (Column D + E on G703) $ 0.00
   b. 0 % of Stored Material (Column F on G703) $ 0.00

Total Retainage (Lines 5a + 5b or Total in Column I of G703) $ 0.00

6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total) $ 0.00

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate) $ 0.00

8. CURRENT PAYMENT DUE (Line 3 less Line 6) $ 0.00

9. BALANCE TO FINISH, INCLUDING RETAINAGE

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<th>CHANGE ORDER SUMMARY</th>
<th>ADDITIONS</th>
<th>DEDUCTIONS</th>
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<td>Total changes approved in previous months by Owner</td>
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<td>Total approved this Month</td>
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<td><strong>TOTALS</strong></td>
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The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____________________________________________________________________ Date: __________
State of: ____________________________
County of: __________________________
Subscribed and sworn to before me this day of _______, 20__
Notary Public: ________________________
My Commission expires: ______________

CERTIFICATE FOR PAYMENT

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

AMOUNT CERTIFIED ................................................................................................................ $ 0.00

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

CONSTRUCTION MANAGER:

By: _____________________________________________________________________ Date: __________
ARCHITECT:

By: _____________________________________________________________________ Date: __________

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

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor’s signed certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

<table>
<thead>
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<th>ITEM NO.</th>
<th>DESCRIPTION OF WORK</th>
<th>SCHEDULED VALUE</th>
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**APPLICATION NO:**

**APPLICATION DATE:**

**PERIOD TO:**

**ARCHITECT'S PROJECT NO:**

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**TOTAL COMPLETED AND STORED TO DATE**

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**% (G ÷ C)**

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**BALANCE TO FINISH (C - G)**

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**RETAIENAGE (IF VARIABLE RATE)**

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**GRAND TOTAL**

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</table>
Contractor's Affidavit of Payment of Debts and Claims

PROJECT: (Name and address)  ARCHITECT'S PROJECT NUMBER:  
OWNER:  
ARCHITECT:  
CONTRACTOR:  
SURETY:  
OTHER:  

CONTRACT FOR:  

TO OWNER: (Name and address)  CONTRACT DATED:  
Harrisburg Area Community College  
One HACC Drive  
Harrisburg, PA 17110  

STATE OF:  
COUNTY OF:  

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

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:  
1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose. 
Indicate Attachment  
☐ Yes  ☐ No  

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

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

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


CONTRACTOR: (Name and address)  

BY:  
(Signature of authorized representative)  
(Printed name and title)  

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:
Contractor's Affidavit of Release of Liens

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

TO OWNER: (Name and address)
Harrisburg Area Community College
One HACC Drive
Harrisburg, PA 17110

CONTRACT DATED:

STATE OF:
COUNTY OF:

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

EXCEPTIONS:

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

CONTRACTOR: (Name and address)

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:
My Commission Expires:
Consent Of Surety to Final Payment

PROJECT: (Name and address)  
ARCHITECT'S PROJECT NUMBER:  
OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
SURETY: ☐
OTHER: ☐

TO OWNER: (Name and address) 
Harrisburg Area Community College 
One HACC Drive 
Harrisburg, PA 17110

CONTRACT DATED:  

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

on bond of  
(Insert name and address of Contractor)

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

as set forth in said Surety's bond.

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

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):
SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination Drawings.
4. Administrative and supervisory personnel.
5. Project meetings.

B. Each contractor shall participate in coordination requirements. Different areas of responsibility have been assigned to specific contractors.

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section "Summary of Contract" for a description of the division of Work among separate contracts and responsibility for coordination activities not in this Section.
2. Division 1 Section "Construction Progress Documentation" for preparing and submitting the Contractor's Construction Schedule.
3. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
4. Division 1 Section "Closeout Procedures" for coordinating Contract closeout.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

1.4 SUBMITTALS

A. Coordination Drawings: If required by project scope, the HVAC Contractor shall produce and coordinate coordination drawings for all phases, mechanical and ceiling cavity work. Prepare Coordination Drawings to maximize utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.6 PROJECT MEETINGS

A. Preconstruction Conference: The Construction Manager shall schedule a preconstruction conference before starting construction, but no later than 15 days after execution of the Agreement. The conference shall be held at Project site or another convenient location.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Each Contractor and their superintendent and foremen; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

   a. Tentative construction schedule.
   b. Phasing.
   c. Critical Path work sequencing.
   d. Designation of responsible personnel.
   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. Responsibility for temporary facilities and controls.
   l. Parking availability.
   m. Office, work, and storage areas.
   n. Equipment deliveries and priorities.
o. First aid.


q. Progress cleaning.

r. Working hours.

3. The Construction Manager will record significant conference discussions, agreements, and disagreements and publish meeting minutes.

1.7 PROJECT COMMUNICATION

A. The Construction Manager shall copy the Contractor and major subcontractors with all job related correspondence and attachments including, but not limited to:

1. RFI's

2. Change Proposals

3. Transmittals and Applicable Attachments

4. Scheduling Input

5. Emails of significance

6. Faxes of significance

1.8 PROJECT REPRESENTATIVE

A. The Contractor shall direct all project communications and correspondence to the Construction Manager. The Construction Manager replaces the Owner as a recipient of project related correspondence where required throughout the Contract Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310
SECTION 01320 • CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Preliminary Construction Schedule.
   2. Contractor's Construction Schedule.

B. Related Sections include the following:
   1. Division 1 Section "Summary of Multiple Contracts" for preparing a combined Contractor's Construction Schedule.
   2. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
   3. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   4. Division 1 Section "Submittal Procedures" for submitting schedules and reports.

1.3 SUBMITTALS

A. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.
   1. Provide schedule of sufficient size to display in field office for owner, architect and contractor reference.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

   1. Activity Duration
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
   4. Startup and Testing Time
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

   1. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
2.2 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the construction duration.

2.3 CONTRACTOR’S CONSTRUCTION SCHEDULE (CPM SCHEDULE)


PART 3 - EXECUTION

3.1 CONTRACTOR’S CONSTRUCTION SCHEDULE

A. Contractor’s Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320
SECTION 01330 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting Applications for Payment.
2. Division 1 Section "Project Management and Coordination" for submitting Coordination Drawings.
3. Division 1 Section "Quality Requirements" for submitting test and inspection reports and Delegated-Design Submittals and for erecting mockups.
4. Division 1 Section "Product Requirements" for substitutions.
5. Division 1 Section "Closeout Procedures" for submitting warranties
6. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
7. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and samples that require Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect's approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of drawings of the Architectural Backgrounds, (drawings as utilized by the Architect as general, or overall floor plans and reflected ceiling plans ONLY), will be provided by the Architect a cost for each Prime Contractor's use in preparing submittals. Mechanical, plumbing, electrical and/or structural drawings ARE NOT available to the contractors. **Note that it is an infringement of the copyright laws of the Commonwealth of Pennsylvania to utilize, or otherwise copy, the Architect's drawings without the Architect's express written consent.**
1. The Contractor must request, and sign, the appropriate release of liability disclaimer prior to the Architect's release of any electronic data or drawing files.

2. ONLY Prime Contractors will be provided the opportunity of securing Architectural background drawings on CD. All suppliers, fabricators, subcontractors etc. requiring such shall be provided access to the information by the Prime contractors.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities to expedite completion of the Work.

   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.

   1. Review: Allow 10 working days, minimum after receipt of document by Architect for review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 15 working days minimum for first review of each submittal.
   3. If revised submittal is necessary, process it in same manner as first submittal.
   4. No extension of the Contract Time will be authorized because of failure to transmit submittals sufficiently in advance of the Work to permit processing.
   5. No extension of Contract Time will be authorized for the Contractor's delaying of the submittal process by not promptly complying with the intent of the submittal process.

D. Identification: Place a Submittal Cover Sheet (Appendix A) on each submittal copy for identification.

   1. Indicate name of entity and individual that prepared each submittal on cover sheet.
   2. Record Contractor's review and approval markings and action taken by Architect.
      a. Submittals received by the Architect that have NOT been reviewed by the prime contractor prior to such submittal, will be returned to the prime contractor without action.
      b. Submittals must be sent from the prime contractor. Submittals sent directly from a sub-contractor will not be reviewed.
   3. Include the following information on Submittal Cover Sheet for processing and recording action taken:
      a. Project name (exactly as indicated on the Contract drawings)
      b. Project number (exactly as indicated on the Contract drawings).
      c. Date of the submission.
      d. Name and US Postal service mailing address of Architect.
e. Name, address, phone/fax number of Prime Contractor and/or Subcontractor and individual preparing the submittal.

f. Name, address, phone/fax number of supplier preparing the submittal.

g. Name, address, phone/fax number of specific manufacturer.

h. Specification Section No. and Drawing No. Unique Identifier, including revision number, as follows:

1) Specifications section or Drawing number.

2) Sequential number of items submitted for each section or Drawing.

3) If Submittal is a re-submission, utilize alphabet to list submissions in chronological order: i.e. 08130-2-A and 08130-2-B for specification items, and A5.01/3-A (Detail 3) and A5.01/3-B for Drawing items.

4) If submittal is a resubmission, cloud and identify each revision edition using delta symbols with revision numbers inside. Date all previous delta revisions to submittal and show in title block.

i. Drawing number shall include detail references, if applicable, beside drawing number.

j. Other necessary identification.

E. Deviations: Highlight, or otherwise identify deviations from the Contract Documents on submittals.

F. Consecutive/Total Numbering: Each Drawing, individual data sheet, or booklet pages shall be custom numbered at the bottom by the Contractor with black ink or marker. Number each page (i.e.: "1 of 6" or "2 of 6", etc.).

G. Legibility: The Architect shall return illegible submittals to the Contractor without action. They will be sent back until a submission is completely legible. Do not send fax submittals; only legible first generation submittals will be reviewed.

H. Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a form. Architect will discard submittals received from sources other than the prime Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements of the Contract Documents, including minor variations and limitations. Include the same label information as the related submittal.

2. Include Contractor's certification stating that information submitted complies with requirements of the Contract Documents.

3. Transmittal Form:

   a. Date of Transmittal.
   
b. Project Name as indicated on Project Documents
   
c. Destination (To:).
   
d. Source (From:).
   
e. Submittal and transmittal distribution record.
   
f. Remarks as appropriate to approval status.
   
g. Signature of transmitter.
I. Distribution: Furnish copies of approved submittals to each Prime Contractor, manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, the General Contractor at their field office, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

1. The General Contractor shall receive approved submittals from all Prime Contractors. A locked file of approved submittals shall be maintained at the site by the General Contractor. This complete set of record submittals shall be turned over to the Owner at Substantial Completion. Missing Shop Drawings shall be replaced by the entity responsible for preparing such, unless proof can be offered that the General Contractor has received such, in which case, Missing Shop Drawings shall be replaced by the General Contractor.

J. Use for Construction: Use only approved submittals with mark indicating action taken by Architect in connection with construction.

K. Do not fabricate products or begin work that requires submittals until return of submittals with Architect's review stamp indicating approval to proceed.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: All Submittals listed within this Article require Action by the Architect. Prepare and submit Action Submittals required by individual Specification Sections. Refer to Article 3 for information regarding the Contractor prepared Action submittal log.

1. Substitutions: The Contractor shall not use submittal procedures to attempt material, product, or process substitutions. Substitutions shall be made in accordance with Division 1 Section “Product Requirements”. Submittals that are deemed substitution attempts by the Architect shall be returned to the Contractor with no action taken. Repeated attempts at substitutions through the submittal procedure process shall be construed as Contractor delays to the Work.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products, model numbers, sizes, finishes and options are applicable.
3. Include the following information, as applicable:

   a. Manufacturer's written recommendations.
   b. Manufacturer's product specifications.
   c. Manufacturer's installation instructions.
   d. Color charts, or Samples as required.
   e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operating and maintenance manuals.
k. Compliance with recognized trade association standards.
l. Compliance with recognized testing agency standards.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Catalog Cuts: Provide three catalog cuts, data sheets and installation instructions with all options encircled in black and noted (plus whatever the Contractor needs for their records and distribution). Staple one Submittal Cover Sheet to each one of the cuts. Architect will return all but three cuts to the Contractor for distribution as necessary after submittal is reviewed.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not just reproduce Architect’s Drawings. If Architect’s drawings are used they shall be added to by the Contractor. The Contractor shall add coordination and adjacency information gathered from all applicable effected trades crucial to a proper installation.

1. Information available on the Architect’s drawings may be used in the preparation of shop drawings only if it serves the work as follows:

   a. To facilitate the actual routing of site and building utilities as they are coordinated by all trades to fit into or onto the built work.
   b. Is not used for the actual manufactured dimensions of items to be installed into or onto work by other trades.
   c. Provides a background for the installation of work that is further elaborated upon by additional coordination, information, and detail for the proper installation of work.

2. Preparation: Include the following information, as applicable:

   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Shop work manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.

3. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
4. 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 36-inches in any direction.

5. Drawings: Provide one vellum transparency and three blueline (or blackline) prints of each submittal drawing. Staple one Submittal Cover Sheet to each drawing. Architect will return vellum with stamped and initialed Submittal Cover Sheet (Contractor to list each submittal drawing number on the transmittal) only to the Contractor for their reproduction and distribution necessary when submittal is reviewed.

D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."

E. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

F. Samples: Prepare physical units of materials or products each with a Submittal Cover Sheet, including the following Comply with requirements in Division 1 Section "Quality Requirements" for mockups.

2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

3. Contractor shall gather and hold at their office all building finish related samples. Do not submit to Architect until Contractor has all such samples in hand. Submit together in a box with a transmittal and submittal cover sheet that lists each item numerically by CSI 16 Division Master form and then alphabetically. Failure to submit finish samples in the specified manner may be construed by the Architect as a delay on the part of the Contractor.

4. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the 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.

5. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:

a. Generic description of Sample.
b. Product name or name of manufacturer.
c. Sample source.
d. Specification Section

6. Sample Accompanying Information: On an attached separate sheet, prepared on or itemized on Contractor's letterhead, provide the following:

a. Size limitations.
b. Compliance with recognized standards.
c. Availability.
d. Delivery time.

7. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

8. Samples for Product, or Color Selection: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal indicating selection.

9. Samples for Verification: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.

a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

10. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections. All Submittals listed within this Article are Informational only, and are not to be submitted with Action Submittals. Prepare and submit Informational Submittals required by individual Specification Sections. Refer to Article 3 for information regarding the Contractor prepared Informational submittal log.

B. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
C. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."

D. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation".

E. Submittal Schedule / Log: In addition to the requirements listed herein, Comply with requirements in Division 1 Section "Construction Progress Documentation."

F. Subcontract List: Within 30 calendar days of the notice to proceed, Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.

G. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

H. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

I. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.

J. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.

K. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.

L. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.

M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.

N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.

P. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Q. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

R. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Sections "Closeout Procedures and /or Operation and Maintenance Data."

S. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

T. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

U. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

V. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

W. Material Safety Data Sheets: Obtain for use by Contractor during construction. If submitted to Architect, Architect will not review this information and will return it to the Contractor. Disseminate information on each product’s M.S.D.S. to workers. Bind M.S.D.S. on each product and turn over to Owner as a closeout document.

PART 3 - EXECUTION

3.1 ACTION SUBMITTAL LOG

A. The Contractor shall prepare an Action Submittal Log for their use and the Owner’s and Architect’s information.

1. The Submittal Log shall be developed using the specification section numbers and product identification nomenclature and the drawing identification information.

3.2 INFORMATIONAL SUBMITTAL LOG – (NO ACTION REQUIRED)

A. Each Prime Contractor shall prepare an “Informational Submittal Log” for “No Action Required” submissions for the Contractor’s, Owner’s, and Architect’s use with the Action Submittal Log.

1. The Submittal Log shall be developed using the specifications section numbers and product identification nomenclature and drawing identification information.
2. Informational Submittals must be submitted at least 21 workdays prior to the start of work of any section requiring such submittal.
3. Refer to the end of this section for the Submittal Log: Appendix B.
4. Number of Copies: Submit three copies of each informational submittal, unless otherwise indicated. Architect will not return copies.
5. The Information Submittal Log shall include special warranties, Operation and Maintenance manuals and attic stock due Owner at Substantial Completion.
3.3 CONTRACTOR'S REVIEW

A. Review each Action, and Informational submittal for compliance with the Contract Documents. Note corrections and field dimensions. Mark Submittal Cover Sheet with Contractor’s approval stamp before submitting to Architect.

1. Approval Stamp: Stamp each Submittal Cover Sheet 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.

2. Approval stamp shall contain statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents. Stamp shall mean that the Contractor has verified the products required, field dimensions, and coordinated submission with adjacent work.

3. The Architect will reject and return any submittals that do not represent review and approval by the contractor.

3.4 ARCHITECT’S ACTION

A. General: Architect will not review submittals that do not bear Contractor’s approval stamp and signature. Architect will return them without action.

B. The Architect’s review of submittals is only for the purpose specified in the General Conditions of the Contract.

C. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each Submittal Cover Sheet with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. APPROVED: Indicates that the submittal, in the design professional’s opinion, conforms with the information given, and the design concept, as expressed in the contract documents.

2. APPROVED AS NOTED: Indicates that the Submittal has been modified as indicated thereon by the Design professional. Re-submittal is NOT required and the Contractor may proceed in accordance with the modified submittal.

   a. Approved as Noted/Submit Corrected Copy for Record: The Architect may request a corrected copy for the record while the Contractor proceeds with the Work as noted.

3. NOT APPROVED: Indicates that the Submittal, in the design professional’s opinion, does not conform with the information given, and the design concept, as expressed in the contract documents, or that the submittal does not meet the procedural requirements of the contract documents. The Design Professional, at their discretion, may offer more information as to the nature of the submittals non-conformity.

4. No Action Required Informational Submittals: Architect will review each submittal. Submittals will not be returned unless, in the opinion of the Architect, the information provided does not conform with the requirements, as expressed in the contract documents, or that the submittal does not meet the procedural
requirements of the contract documents. The Architect, at their discretion, may offer more information as to the nature of the submittals non-conformity.

5. **No Action Required**: Submittals not required by the Contract Documents will not be reviewed and may be discarded.

6. The Contractor accepts all responsibility for the usability, fit, durability, warrantability, and industry-wide intended life expectancy of installed products or systems that have not been submitted to the Architect for approval.

3.5 APPENDIX A SUBMITTAL COVER SHEET is bound at the end of this section.

END OF SECTION 01330
SUBMITTAL COVER SHEET
(Attach to each copy of submittal)

PROJECT NAME: Repairs to Evans Gym Pools

ARCHITECT’S PROJECT No: ———

PRIME CONTRACTOR: ————
Phone: ————
Fax: ————

SUBCONTR./SUPPLIER: ————
Phone: ————
Fax: ————

<table>
<thead>
<tr>
<th>Section Number</th>
<th>Description</th>
<th>Major Manufacturer(s)</th>
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<tr>
<th>Construction Submittal</th>
<th>Close-Out Submittal</th>
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<tr>
<td>Product Data</td>
<td>Warranty</td>
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<tr>
<td>Sample</td>
<td>O&amp;M Data</td>
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<tr>
<td>Warranty</td>
<td>Test Report</td>
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<td>Color Selections</td>
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<td>Certificates</td>
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<td>Test Reports</td>
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<td>Other</td>
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<td>Shop Drawing</td>
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This submittal has been reviewed by the Contractor and is in accordance with the Contract Documents. The Contractor will field verify all dimensions prior to fabrication. The contractor has notified the Architect in writing of any changes to the Contract Documents. **Incomplete or incorrect submittals will be returned by the Architect without review.**

Signed:

Contractor

Received by Architect

Received by Consultant

Received by Consultant

Received by Contractor

Johnson, Mirmiran, Thompson
200 St. Charles Way, Suite 200
York, PA 17402

Conforms

Conforms as noted

Revise and resubmit

Rejected

Review not required

Review is for general conformance with the design concept and contract documents only. Contractor is responsible for quantities, dimensions, relationships, field conditions, coordination, and for furnishing materials and workmanship in accordance with the contract documents.

Date: ————

By: ————

Architect’s Stamp

Consultant’s Stamp/Notes
SECTION 01400 – QUALITY REQUIREMENTS

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 administrative and procedural requirements for quality assurance and quality control.
   1. The Contractors shall provide all material testing in accordance with this section and individual specification sections.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements. The Contractor shall provide qualified staff to monitor compliance.
   1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.

C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
1.4 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
   1. Acceptable Testing Agencies:
      a. Firm shall:
         1) Submit credentials to the Architect and be acceptable to perform designated tests and inspections.
         2) Shall have been in business for at least 5 years and be located within 100 miles of the site.
         3) Shall be managed by a registered professional engineer of the authorized to sign the test reports.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Description of test and inspection.
   3. Identification of applicable standards.
   4. Identification of test and inspection methods.
   5. Number of tests and inspections required.
   6. Time schedule or time span for tests and inspections.
   7. Entity responsible for performing tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

D. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Ambient conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the Commonwealth of Pennsylvania and is experienced in providing engineering services of the work indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
1.7 QUALITY CONTROL

A. Contractor Responsibilities: Provide quality-control testing assistance services specified and required by authorities having jurisdiction.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
6. Notify the Architect by phone and fax of all non-complying work as soon as it is discovered.
7. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Special Tests and Inspections: Owner may engage a testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and reinspect corrected work.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.


1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 STATEMENT OF SPECIAL INSPECTIONS

Contractor shall comply with the requirements of the "Statement of Special Inspections", 3 pages, included in this section of the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."

B. Protect construction exposed by or for quality-control service activities.
C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400
SECTION 01500 – TEMPORARY FACILITIES AND CONTROLS

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 requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities. The General Contractor shall provide all temporary facilities and controls not specified to be by others herein, or elsewhere.

B. Temporary utilities include, but are not limited to, the following:

1. Water service and distribution.
2. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
3. Heating and dehumidification facilities.
4. Ventilation.
5. Electric power service.
7. Telephone service.

C. Support facilities include, but are not limited to, the following:

1. Temporary roads and paving.
2. Dewatering facilities and drains.
3. Project identification and temporary signs.
5. Field offices.
6. Storage and fabrication sheds.
7. Lifts and hoists.
8. Temporary stairs.
9. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:

1. Environmental protection.
2. Stormwater control.
3. Tree and plant protection.
4. Pest control.
5. Security enclosure and lockup.
6. Barricades, warning signs, and lights.
7. Temporary enclosures.
8. Temporary partitions.

E. Related Sections include the following:

1. Division 1 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
2. Division 1 Section "Execution Requirements" for progress cleaning requirements.
3. Divisions 2 through 16 for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined solely by Architect, permanent roofing is complete, insulated, and weather tight; exterior walls are insulated and weather tight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. This is a single contract project, as such the contractor is responsible for all use charges.

1.5 SUBMITTALS

A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

1.6 QUALITY ASSURANCE

   1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
B. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively.

D. Paint: Comply with requirements in Division 9 Section "Painting."

E. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

F. Water: Potable.

2.2 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Fire Extinguishers: Hand carried, portable, UL rated; provide 10 LB ABC extinguishers spaced around jobsite (hung at visible locations) to meet NFPA, OSHA and local Fire Marshall’s requirements.

1. In addition provide extinguishers complying with NFPA 10 and NFPA 241 for exposure classification, extinguishing agent, and size required by location and class of fire exposure.

C. Self-Contained Toilet Units: Single-occupant units of chemical type; vented; fully enclosed and screened with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupter, reset button, and pilot light.

E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION
A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Water Service: Provide 1" temporary water line, from existing building water service to area convenient for all contractor's use.
   1. Provide rubber hoses as necessary to serve Project site.
   2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
   3. Label temporary water service outlet as "DO NOT DRINK".

C. Sanitary Facilities: General Contractor shall provide and service two portable toilets. Use of existing School facilities is prohibited.

D. Heating and Dehumidification: Provide temporary heating and dehumidification required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
   1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.
   2. Control relative humidity in building when installing finishes so that RH does not exceed 60% or comply with more stringent requirement of finish manufacturer.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Protect workers or occupants from excessive carbon monoxide levels created by internal combustion motors inside building envelope.

F. Electric Power Service: The Contractor shall provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
   1. Install power distribution wiring overhead and rise vertically where least exposed to damage.
2. Connect temporary service to existing building, as directed by electric company officials and Owner's Staff.

G. Electric Distribution: The Contractor shall provide receptacle outlets adequate for connection of power tools and equipment.
   1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
   2. Provide warning signs at power outlets other than 110 to 120 V.
   3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
   4. Provide metal conduit enclosures or boxes for wiring devices.

H. Lighting: The Electrical Contractor shall provide temporary building and site lighting with local switching that provides adequate illumination for construction operations and traffic conditions. Lighting shall meet OSHA requirements and added requirements below:
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Provide one 100-W incandescent lamp per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
   3. Provide one 100-W incandescent lamp every 50 feet in corridor areas.
   4. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
   5. Provide one 100-W incandescent lamp in each space.
   6. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and security and signage visibility when the Work is being performed.
   7. Install lighting for Project identification sign.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access and as acceptable to Owner's representative.
   2. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
   3. Maintain support facilities until Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary road ways and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.
   1. Contractor personnel shall not park in existing School parking.
2. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing if temporary paving is in permanent parking area.

4. If binder course of asphalt is placed in an asphalt paving area and used as temporary paving the Contractor shall delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 2 Section "Hot-Mix Asphalt Paving."

5. Provide paved gravel roadways for crane travel, lift stations, and flatbed truck staging.

C. Snow Removal: Remove all snow from work areas, temporary road, temporary parking, and trailer sidewalks.

D. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.

E. Dewatering Facilities and Drains: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.

2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.

3. Remove snow and ice as required to minimize accumulations.

F. Project Identification and Temporary Signs: Provide Project identification and other signs as indicated on Drawings following this Section. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

1. Provide temporary, directional signs for construction personnel and visitors.

2. Maintain and touch up signs so they are legible at all times

3. Project Identification Sign: Refer to details following this Section. Coordinate with Architect and Construction Manager for their company logo graphics.

G. Waste Disposal Facilities: Provide dumpsters with canvas covers to be secured tightly in place around rim at the end of the working day; empty dumpsters off site when full. Contractor shall remove all construction trash and debris from building and from site and dispose of off site.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION
A. Tree and Plant Protection: Install temporary fencing located outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

B. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.

1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch-thick exterior plywood.

C. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.

D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

1. Construct dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant plywood on construction side.
2. Insulate partitions to provide noise protection to occupied areas.
3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
4. Protect air-handling equipment.
5. Weather strip openings.

E. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
   a. Field Offices: Class A stored-pressure water-type extinguishers.
   b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.

2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are the property of Contractor.
   a. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."

3.6 SITE WORKPLACE REGULATIONS

A. Construction personnel at the site shall abide by the following regulations or be requested to leave permanently by the Owner's onsite representative. Upon notification of the worker's Superintendent the unacceptable worker shall gather their tools and personal belongings and be off the site in 10 minutes or less. The worker shall not return to the site until final payment has been received by each Contractor:

1. Smoking or the use of any tobacco product is not permitted in or within 50 feet of the structure.
2. Foul or abusive behavior (including language) is forbidden.
3. Disruptive behavior threatening jobsite productivity is forbidden.
4. Vandalism or malicious behavior is forbidden.
5. Being present under the influence of alcohol, mind altering legal or illegal drugs is forbidden.
6. Improper dress as deemed inappropriate by the Owner's Representative.
7. Consistent disregard for workplace cleanliness. Review final draft of this Section with Owner. Advise Owner that any exceptions to its provisions might translate into costs borne by Owner.

END OF SECTION 01500
SECTION 01600 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
   1. Division 1 Section "References" for applicable industry standards for products specified.
   2. Division 1 Section "Closeout Procedures" for submitting warranties for contract closeout.
   3. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility, 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 through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

E. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

1.5 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed. Requests received after that time will be rejected by the Architect.

B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

2. Requested substitution does not require extensive revisions to the Contract Documents.

3. Requested substitution is consistent with the Contract Documents and will produce indicated results.

4. Substitution request is fully documented and properly submitted.

5. Requested substitution will not adversely affect Contractor's Construction Schedule.

6. Requested substitution has received necessary approvals of authorities having jurisdiction.

7. Requested substitution is compatible with other portions of the Work.

8. Requested substitution has been coordinated with other portions of the Work.

9. Requested substitution provides specified warranty.

10. Substitution Request Form: Use Appendix "A" Substitution Request form provided at end of this Section. Submit three copies of each request with supporting documents for consideration.
11. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Point-by-Point Comparative Data: Write a detailed comparison of each specified and specified manufacturer's qualities with those of the proposed substitution. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   b. List up to three similar installations for completed projects with project names and addresses.
   c. Proposed substitution affects dimensions, functional clearances and building utility rough-ins of other parts of Work. Provide coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
   d. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   e. Cost information, including a proposal of change, if any, in the Contract Sum.
   f. Drawings showing incorporation of proposed substitution into the Work. Show changes, dimensions or functional clearances affected by incorporation of proposed substitution into Work.
   g. Product Data shall include drawings and descriptions of products and fabrication and installation procedures.
   h. Samples, shall be submitted when applicable or requested.
   i. Contractor's certification that proposed substitution complies with the intent of the requirements in the Contract Documents and is appropriate for applications indicated.

12. 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: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated, or proposed substitution is rejected.

1.6 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
   1. Each Contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.
1.7 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Store products to allow for inspection and measurement of quantity or counting of units.
6. Store materials in a manner that will not endanger Project structure.
7. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
9. Protect stored products from damage.

B. Storage: Provide a secure location and enclosure at Project site for storage of materials and equipment. Coordinate location with Owner.

1.8 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
4. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."
PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with substitution requirements to obtain approval for use of an unnamed product.

B. Product Selection Procedures: Procedures for product selection include the following:

1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
   a. Substitutions may be considered, unless otherwise indicated.

2. Manufacturer/Source: Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide a product by the manufacturer or from the source named that complies with requirements.
   a. Substitutions may be considered, unless otherwise indicated.

3. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
   a. Substitutions may be considered, unless otherwise indicated.

4. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
   a. Substitutions may be considered, unless otherwise indicated.
5. Available Products: Where Specification paragraphs or subparagraphs titled "Available Products" introduce a list of names of both products and manufacturers, provide one of the products listed or another product that complies with requirements. Comply with substitution requirements to obtain approval for use of an unnamed product.

6. Available Manufacturers: Where Specification paragraphs or subparagraphs titled "Available Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed or another manufacturer that complies with requirements. Comply with substitution requirements to obtain approval for use of an unnamed product.

7. Product Options: Where Specification paragraphs titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide either the specific product or system indicated or a comparable product or system by another manufacturer. Comply with substitution requirements to obtain approval for use of an unnamed product.

8. Basis-of-Design Products: Where Specification paragraphs or subparagraphs titled "Basis-of-Design Products" are included and also introduce or refer to a list of manufacturers' names, provide either the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with substitution requirements to obtain approval for use of an unnamed product.

9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product (and manufacturer) that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches satisfactorily.

   a. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents on "substitutions" for selection of a matching product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product (and manufacturer) that complies with other specified requirements.

   a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect 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 will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
PART 3 - EXECUTION (Not Used)

Appendix A, Substitution Request Form, pages Appendix A.1 and A.2 bound into the Project Manual after this section.

END OF SECTION 01600
APPENDIX A – SUBSTITUTION REQUEST

Project: Repairs to Evans Gym Pools Substitution Request Number: ____________________________

From: ____________________________

Date: ____________________________

A/E Project Number: ____________________________

Contact For: ____________________________

Specification Title: _____________ Section: ____________________________

Page: ____________________________ Description: ____________________________

Article/Paragraph: ____________________________

Drawing Number and Title: ____________________________ Details Numbered: ____________________________

Proposed Substitution: ____________________________

Manufacturer: ____________________________

Address: ____________________________ Fax: ____________________________

Phone: ____________________________

Trade Name: ____________________________ Model No.: ____________________________

Installer: ____________________________ Phone: ____________________________ Fax: ____________________________

Address: ____________________________

History: [ ] New Product  [ ] 2-5 years old   [ ] 5-10 years old  [ ] More than 10 years old

Differences between proposed substitution and specified product: ____________________________

[ ] Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: ____________________________

Similar Installation:

Project: ____________________________

Address: ____________________________ Phone No.: ____________________________

Architect: ____________________________ Owner: ____________________________ Phone No.: ____________________________

Date Installed: ____________________________

Proposed substitutions affects dimensions, functional clearances and building utility rough-ins of other parts of Work.  

[ ] No  [ ] Yes; explain ____________________________

Provide two more completed-blanks, “Similar Installations” on attached Contractor letterhead stationary as applicable or requested.

Cost Savings to Owner for accepting substitution: ____________________________ ($ ____________________________).

Contractor’s Construction Schedule: Proposed Substitution changes Contract Time:

[ ] No  [ ] Yes (Add) (Deduct) ____________________________ days.
SUBSTITUTION REQUEST (Continued)

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

The Undersigned certifies:
- Proposed substitution complies with the intent of the requirements in the Contract Documents and is appropriate for applications indicated.
- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitutions as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional direct or indirect costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: ____________________________
Signed by: ______________________________
Firm: _________________________________
Address: __________________________________________
Telephone: ______________________________________
Attachments: ______________________________________

A/E’s Review and Action
☐ Substitution approved – Make submittals in accordance with Specification Section 01330.
☐ Substitution approved as noted – Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected – Use specified materials.
☐ Substitution Request received too late – Use specified materials

Signed by: _______________________________ Date: ______________________________

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ 

END OF SECTION 01600A
SECTION 01731 – CUTTING AND PATCHING

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 procedural requirements for cutting and patching.
B. Related Sections include the following:
   1. Divisions 2 through 16 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
      a. Requirements in this Section apply to mechanical and electrical installations. Refer to Divisions 13, 15, and 16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 DEFINITIONS
A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 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.
   1. Block bond beams.
   2. Reinforced masonry walls.
B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   1. Primary operational systems and equipment.
   2. Air or smoke barriers.
   3. Fire-protection systems.
4. Control systems.
5. Communication systems.
6. Electrical wiring systems.
7. Operating systems of special construction in Division 13 Sections.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect’s opinion, reduce the building’s aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner. The Architect shall be the sole judge of the acceptable quality of patched finishes.

1. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

   a. Processed concrete finishes.
   b. Preformed metal panels.
   c. Roofing.
   d. Firestopping.
   e. Window wall system.
   f. Fluid-applied flooring.
   g. HVAC enclosures, cabinets, or covers.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.
PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 RESPONSIBILITY

A. The General Contractor shall cut and patch all interior or exterior finished openings unless noted otherwise. All other trades shall pay the General Contractor for cutting and patching new construction openings required.

B. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing 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 Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE
A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut existing 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 existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original installer’s written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete 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 Division 2 Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
      b. Delete or revise first subparagraph below to suit Project.
4. Ceilings: Patch, repair, or re-hang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.

END OF SECTION 01731
SECTION 01732 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of a building or structure.
   2. Demolition and removal of selected site elements.
   3. Repair procedures for selective demolition operations.

B. Related Sections include the following:
   1. Division 1 Section "Summary of Prime Contracts" for contractors responsibilities, and use of the premises.
   2. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   3. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations.
   4. Division 13 Sections for demolishing, cutting, patching, or relocating fire suppression and fire alarm items.
   5. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
   6. Division 16 Sections for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP
A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tables, antiques, and other items of interest or value to owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and delivery promptly to Owner.
   1. Coordinate special procedures for removal and salvage with Owner.

1.5 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Proposed Dust and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

C. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building and on site operations are uninterrupted.
   2. Interruption of utility services.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of elevator and stairs.
   5. Locations of temporary partitions and means of egress.
   6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Firm Qualifications: An experienced firm that has conducted work similar in material and extent to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ANSI A10.6 and NFPA 241.
1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours written notice to Owner of activities that will affect Owner's operations.

B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
   1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for condition of areas to be selectively demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site will not be permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Confirm with the owner the existence of any warranties for products or materials to be selectively or partially demolished prior to disturbing.
   1. Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Confirm extent of existing warranties with Owner's representative prior to engaging in selective demolition operations.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

A. Use repair materials identical to existing materials.
1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

2. Use material whose installed performance equals or surpasses that of existing materials.

B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

3.2 UTILITY SERVICES

A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.

B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.

1. Provide at least 72 hours written notice to Owner if shutdown of service is required during changeover.

2. Interruptions shall occur during nights and weekends.

C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

1. Each trade present at the site whose contract requires a license to perform this Work will coordinate and perform actual shut-off, cutting, capping or wire cutting at utility entry point into site or work area. The Contractor for General Construction will remove all Division 13, 15 and 16 demolition items embedded in or attached to existing construction that are in the way of this Work from the site. These items shall be of salvage value only to the General Contractor.
2. Arrange to shut off indicated utilities with utility companies. Coordinate with Owner.

3. If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.

4. Cut off pipe or conduit in walls or partitions to be removed. Cap, shut-off valve, or plug and seal remaining portion of pipe or conduit after bypassing.

D. Individual Trade Utility Disconnection Requirements: Refer to Division 13, 15 and 16 Sections for requirements for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and capping, shut-off valve installation, plugging or sealing have been completed and verified in writing.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

3. Protect existing site improvements, appurtenances, and landscaping to remain.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.

C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
D. **Temporary Partitions:** Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

### 3.4 POLLUTION CONTROLS

A. **Dust Control:** Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.

B. **Disposal:** Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. **Cleaning:** Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

### 3.5 SELECTIVE DEMOLITION

A. **General:** Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.
10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.

B. Existing Facilities: Comply with Owner's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

C. Removed and Salvaged Items: Comply with the following:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's on-site storage area.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items: Comply with the following:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

F. Concrete: Demolish in small sections. Cut concrete to a depth of at least 3/4 inch at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.

G. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

H. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

I. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.

3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations. Comply with Division 1 Section "Cutting and Patching."
3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Burning: Burning of demolished materials will NOT be permitted on Owner's property.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

D. Disposal of other unsuitable fill: Transport demolished materials considered unsuitable fill off Owner's property and legally dispose of them.

END OF SECTION 01732
SECTION 01770 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
3. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
4. Division 1 Sections for General and HVAC system Commissioning.
5. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
6. Division 1 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
7. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Advise Owner of changeover in heat and other utilities.
12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
13. Complete final cleaning requirements, including touchup painting.
14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection 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

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

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

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect
   d. Name of Contractor.
   e. Page number.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed
description of the product or installation, including the name of the product and
the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title
"WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance
manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer
or fabricator of the surface to be cleaned. Do not use cleaning agents that are
potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning.
Clean each surface or unit to condition expected in an average commercial building
cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for
certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction
activities, including landscape development areas, of rubbish, waste
material, litter, and other foreign substances.

b. Sweep paved areas broom clean. Remove petrochemical spills, stains,
and other foreign deposits.

c. Rake grounds that are neither planted nor paved to a smooth, even-
textured surface.

d. Remove tools, construction equipment, machinery, and surplus material
from Project site.

e. Remove snow and ice to provide safe access to building.

f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free
condition, free of stains, films, and similar foreign substances. Avoid
disturbing natural weathering of exterior surfaces. Restore reflective
surfaces to their original condition.

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g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

h. Sweep concrete floors broom clean in unoccupied spaces.

i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscurring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean ducts, blowers, and coils if units were operated without filters during construction.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770
SECTION 01781 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include the following:
1. Division 1 Section "Closeout Procedures" for general closeout procedures.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 2 through 16 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Submit 2 sets of red-lined Record Prints to the Owner.

2. Submit 2 electronic copies (CD-ROM discs) of record prints reflecting the changes shown on the red-lined record prints. Format is to be AutoCAD 2004 (.dwg files).

B. Record Specifications: Submit 1 copy of Project Specifications, including addenda and contract modifications.

C. Record Product Data: Submit 1 copy of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit an extra copy as a record copy.
PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue-or black-line white prints of the Contract Drawings and Shop Drawings at the project site.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an understandable drawing technique.
   c. Record data as soon as possible after obtaining it. Record and check the 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. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on and/or to the Contract Drawings.

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 not indicated in original contract drawings.

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
   5. Note related Change Orders and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

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 modifications to Project Record Documents as they occur; do not wait until the end of Project.
B. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 01781
SECTION 01782 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Maintenance manuals for the care and maintenance of products, materials, and finishes systems and equipment.

B. Related Sections include the following:

1. Division 1 Section "Summary of Multiple Contracts" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
2. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
3. Division 1 Section "Closeout Procedures" for submitting operation and maintenance manuals.
4. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
5. Divisions 2 through 16 Sections for specific operation and maintenance manual requirements for products in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.
1.4 SUBMITTALS

A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will return 1 copy of draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit 3 copies of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 COORDINATION

A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with the same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."
2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect.
7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents per CSI 16 Division Masterformat and alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets. Include CSI 16 Division 5 digit Masterformat numbers representing documents inside.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.


5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

   1. Fire.
   2. Flood.
   5. Power failure.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner’s operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.
2.5 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   1. Inspection procedures.
   2. Types of cleaning agents to be used and methods of cleaning.
   3. List of cleaning agents and methods of cleaning detrimental to product.
   4. Schedule for routine cleaning and maintenance.
   5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard printed maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training videotape, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

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

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

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

END OF SECTION 01782
SECTION 01820 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit two complete training manuals for Owner's use.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training Videotape: Submit two copies at end of each training module.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-instruction Review: Contractor review methods and procedures related to demonstration and training including, but not limited to, the following at Project site:
   1. Inspect and discuss Owner provided locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of Contractor provided educational materials, instructors’ personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. Motorized doors.
2. Equipment with moving parts or dependent on electricity.
3. Fire-protection systems, including fire alarm.
4. Intrusion detection systems.
5. Conveying systems.
6. Medical equipment.
7. Laboratory equipment.
9. Refrigeration systems.
10. HVAC systems.
11. HVAC instrumentation and controls.
12. Electrical service and distribution.
13. Packaged engine generators, including transfer switches.
14. Lighting equipment and controls.
15. Communication systems, including voice and data.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.
   e. Identification systems.
   f. Warranties and bonds.
   g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and
      reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION
   A. Assemble educational materials necessary for instruction, including documentation and
      training module. Assemble training modules into a combined training manual.

3.2 INSTRUCTION
   A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and
      maintain systems, subsystems, and equipment not part of a system.
1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

   1. Schedule training with Owner with at least seven days’ advance notice in writing.

C. Evaluation: At conclusion of each training module, assess and document each participant’s mastery of module by use of an oral and demonstration performance-based test.

D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01820
SECTION 03920 – CONCRETE PATCHING

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: Submit for patching compound and topping compound. Indicate trade name of system proposed, generic name and type, performance characteristics, and chemical resistance.

1.2 DELIVERY, STORAGE, AND HANDLING

A. General:

1. Delivery: Deliver packaged products to site in manufacturer's sealed and labeled containers; inspect to verify compliance with specified requirements.

   a. Label containers to indicate manufacturer's name, product name, date of manufacture, and instructions for use.

2. Storage: Store liquid materials in tightly covered containers in well ventilated area at ambient temperatures recommended by manufacturer. Store dry materials on raised platforms and cover to prevent moisture damage. Maintain containers in clean condition, free of foreign materials and residue with labels in legible condition.

   a. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.3 PROJECT CONDITIONS

A. Environmental Requirements: Comply with more restrictive of following or manufacturer's written requirements under which products can be installed.

   1. Maintain minimum ambient temperature of 10 C (50 F) for 24 hours prior, during, and 72 hours after installation.

1.4 COORDINATION

A. Coordinate with other appropriate sections of Specifications including, ceramic tile and resilient flooring, to ensure that Work executed under this Section meets requirements for subsequent installation of various finish floor materials.

PART 2 - PRODUCTS

2.1 CONCRETE RESURFACING
A. Concrete Patching Compound: Two component, cement base, acrylic polymer patching compound for resurfacing and leveling concrete floors, walks, steps, ramps.

1. Locations: Interior.
2. Primer: As recommended by manufacturer.
3. Physical Characteristics (at 28 days):
   a. Compressive Strength: 34 500 kPa (5000 PSI) minimum, ASTM C109.
   b. Tensile Strength: 5200 kPa (750 PSI) minimum, ASTM C190.
   c. Flexural Strength: 10 500 kPa (1500 PSI) minimum, ASTM C348.
4. Acceptable Products:
   a. Masterpatch 210, Master Builders, Cleveland, OH.
   b. SikaTop 122 Plus, Lyndhurst, NJ.
   c. Thoropatch, Thoro System Products, Miami, FL.
   d. Accepted Substitute in accordance with Section 01600.

B. Concrete Topping Compound: Cement based, water resistant, trowelable, freeze/thaw resistant patching and topping compound.

1. Use: Resurfacing and adding slopes to concrete floors, walks, steps, ramps.
2. Exposure: Applicable as wear surface on interior or exterior.
3. Primer: As recommended by manufacturer.
4. Compressive Strength (at 28 days): 33 000 kPa (4800 PSI) minimum, ASTM C109.
5. Acceptable Product:
   a. Polytex, Ardex, Inc., Coraopolis, PA.
   b. SikaTop 111 Plus, Lyndhurst, NJ.
   c. Accepted Substitute in accordance with Section 01600.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate surfaces are clean, dry, unfrozen, free from efflorescence, wax, curing compounds, and do not contain petroleum by-products or other compounds detrimental to material bond to substrate.

3.2 PREPARATION

A. Surface Preparation: Remove loose materials and damaged concrete. Prepare and clean substrate according to manufacturer’s written instructions for substrate indicated. Provide clean, dry, neutral-pH substrate for underlayment application.
1. Clean off oils, grease, dirt, and salt deposits.
2. Chip out existing concrete at perimeter of floor drains to depth of 13 mm (1/2 inch) for distance of 300 mm (12 inches) from drain perimeter.
3. Treat nonmoving substrate cracks to prevent cracks from telegraphing (reflecting) through underlayment according to manufacturer’s written recommendations.
4. Flush surfaces clean.
5. Prime substrate in accordance with manufacturer’s instructions. Allow to dry.

3.3 INSTALLATION

A. Concrete Resurfacing: Mix and install in accordance with manufacturer’s instructions.

1. Do not apply at temperatures below 4 C (40 F) or when temperature is expected to fall below 4 C (40 F) or to frozen or frost-filled surfaces.

B. Concrete Patching Compound: Provide patching compound to infill indentation in existing concrete or tile that are ½ inches or more deep.

1. Provide as closure at unused existing slab penetrations.
2. Provide surface finish for application of concrete topping compound.

C. Concrete Topping Compound:

1. Provide topping compound in area indicated to provide a wear surface or surface to be finished.
2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through topping.
4. Apply primer over prepared substrate at manufacturer’s recommended spreading rate.
5. Apply underlayment to produce uniform, level surface. Feather edges to match adjacent floor elevations.
6. Build up existing floor slab to create slope or positive drainage as indicated.
7. Cure underlayment according to manufacturer’s written instructions. Prevent contamination during application and curing processes.

END OF SECTION 03920
SECTION 05515 - METAL LADDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Steel ladders.

B. Related Sections: Section 09910 - Paints.

1.2 SYSTEM DESCRIPTION

A. Design Requirements: Fabricator: Responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.

   1. Employ registered professional engineer, licensed to practice structural engineering in jurisdiction where Project is located, to engineer each component of ladder system.

B. Structural Requirements: In addition to requirements shown and specified, comply with ANSI A14.3 for design, materials, fabrication, and installation of component parts.

1.3 SUBMITTALS

A. Shop Drawings: Stamp with seal and signature of professional engineer responsible for design.

   1. Indicate dimensions, fabrication and installation details. Indicate size and type of fasteners, welds, accessory items, shop finish and method of anchorage.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:


B. Engineer Qualifications: Registered professional engineer licensed to practice structural engineering in jurisdiction where Project is located, with minimum of five years experience in design of metal ladders.

C. Fabricator Qualifications: Company specializing in fabricating work specified in this Section with minimum five years experience.

D. Welder Qualifications: AWS certified within past 12 months for each type of weld required. Maintain current certification for duration of Project.
PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Section: ASTM A36/A36M.

B. Steel Tubing: 1-1/4 inches NPS ASTM A53, Grade B, Schedule 40, or as required for design loading.

C. Cold-Rolled Structural Steel Sheet: ASTM A611, grade as required for design loading.

D. Hot-Rolled Structural Steel Sheet: ASTM A570/A570M, grade as required for design loading.

E. Galvanized, Structural Steel Sheet: A653/A653M, Quality SQ, Coating Designation G90, Grade as required for design loading.

F. Steel Bar Grating Treads: ASTM A36/A36M.

G. Fasteners:
   1. General: Provide zinc-coated fasteners for exterior use or where built into exterior walls. Select fasteners for type, grade and class required.
   2. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.
   3. Lag Bolts: Square head type, FS FF-B-561.
   5. Wood Screws: Flat head carbon steel, FS FF-S-111.
   8. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.

H. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A47, or cast steel, ASTM A27/A27M. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A153.

2.2 VERTICAL LADDERS

A. General: Comply with OSHA and ANSI A14.3. Provide complete with anchors and accessories:
   1. Side Rails: Minimum 3/8 inch by 2-1/2 inches flat steel bars with eased edges
   2. Rungs: 3/4 inch minimum round steel bars uniformly spaced 12 inches maximum OC, punched through stringers and plug welded.
   3. Angle Supports: Support ladders by steel angles bolted to walls and floors to provide minimum of 7 inches from face of wall to centerline of rungs. Locate at bottom secured to floor and at secured to wall at 5 feet OC maximum and within 16 inches of top and bottom.
2.3 FABRICATION PROCEDURES

A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1. Verify measurements in field for work fabricated to fit job conditions. Before starting work, examine adjoining work on which work of this section is in any way dependent for workmanship and fit.
2. Fabricate finish surfaces smooth, unless otherwise specified.
3. Cut, punch, drill and tap for attachment of work coming in contact with ladder where indicated or where directions for same are given prior to or with approval of shop drawings.
4. Make joints as strong and rigid as adjoining sections. Make exposed joints close fitting and where jointing is least conspicuous. Unless otherwise indicated or specified, full weld joints and seams and dress smooth where exposed.

B. Weights of Connections and Accessories: Meet design loads.

2.4 SURFACE PREPARATION AND APPLICATION

A. Steel Surfaces to be Primed: Dry and free of dirt, oils, rust, salt and other contaminants.

1. Blast-clean steel to SSPC SP-6 Commercial Grade for general use.

B. Apply primers in accordance with manufacturer's instructions.

2.5 UNIVERSAL PRIMER

A. Manufacturer's standard, lead and chromate free primer, capable of providing sound foundation for field applied top coats despite prolonged exposure.

1. Maximum Allowable Dry Time: Four hours to touch; 24 hours to re-coat.
2. Compatible with finish paint system specified in 09910.

B. Acceptable Products:

2. Tnemec, Chem Prime 37H-77, Tnemec, Kansas City, MO.
3. Carboline Multi-Bond 150, Carboline Company, St. Louis, MO.

2.6 FINISHES

A. Interior: Universal primer.

B. Final painting under Section 09910 - Paints.
PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install in accordance with fabricator's recommendations and approved Shop Drawings.

1. Set items in position, align and brace securely until permanent anchorage is made.
2. Install supporting members, fastenings, framing, hangers, bracing brackets, straps, bolts and angles required to set and connect work to structure.
3. Provide suitable anchors for substrate.

B. Upon completion of installations, re-examine work and provide additional shims, washers, anchors and corrective work to ensure that installation is firm, tight, anchored, in alignment with neat fits, without distortion, unsightly fastenings, raw edges or protrusions.

END OF SECTION 05515
SECTION 07920 – ARCHITECTURAL JOINT SEALANTS

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 joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.

B. Related Sections include the following:
   1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.
B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.6 PROJECT 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.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer’s full range.

2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. General Purpose Silicone Sealant (S-GP):

1. Type and Grade: S (single component) and NS (nonsag). Low modulus, single component, neutral curing, non-staining, non-bleeding silicone sealant.
2. Class: 50.
5. Acceptable Products:
   a. Dow Corning Corporation; 756, 790, or 795.
   b. GE Silicones; SilPruf.
   c. Tremco; Spectrem 1.
   d. Pecora Corporation; 890 or 895.

E. Sanitary Silicone Sealant (S-S):

1. Type and Grade:
   a. S (single component) and NS (nonsag).
   b. Neutral or acid curing, non-staining, non-bleeding, fungicide-containing.
   c. Food Service Areas: Comply with US Food and Drug Administration Regulation 21CFR-177-6000.
2. Class: 25.
3. Use Related to Exposure: NT (nontraffic).
4. Uses Related to Joint Substrates: G, A, and O.
6. Acceptable Products:
   a. Pecora Corporation; 898.
b. Dow Corning Corporation; 786 Mildew Resistant.
c. GE Silicones; Sanitary 1700.

F. Multi-Component Urethane Sealant U-MC:

1. Type and Grade: M (multicomponent) and NS (nonsag). Chemical curing, non-staining, and non-bleeding.
2. Class: 25.
3. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Color: Selected by Architect from manufacturer's full color range.
6. Acceptable Products:
   a. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
   b. Tremco; Dymeric 511.
   c. Pecora Corporation; Dynatrol.

G. Traffic Bearing Urethane Sealant U-TB:

1. Type and Grade: M (multicomponent) and P (pourable). Chemical curing, non-staining, non-bleeding.
2. Class: 25 minimum.
3. Uses Related to Exposure: T (traffic).
4. Uses Related to Joint Substrates: M, G, A, and, O.
5. Shore A Hardness: 40 minimum, when tested in accordance with ASTM C661.
7. Acceptable Products:
   a. Pecora Corporation; Urexpans NR-200.
   b. Sika Corporation, Inc.; Sikaflex - 2c SL.
   c. Sonneborn, Division of ChemRex Inc.; SL 2.
   d. Tremco, THC 900 or Vel kem 245.

2.4 LATEX JOINT SEALANTS

A. Acrylic Latex Sealant (AC):

1. Comply with ASTM C 834, Type P, Grade NF.
2. Joint Movement Range without Cohesive/Adhesive Failure: Plus 7.5 percent to minus 7.5 percent of joint width.
3. Color: As selected by Architect from manufacturer's full color range.
4. Acceptable Products:
   b. Sonneborn, Division of ChemRex Inc.; Sonolac.
   c. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints (AS):
1. Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

2. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

3. Acceptable Products:

   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

2.6 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings:

   1. General:

      a. Comply with ASTM C 1330.
      b. Provide Type as approved by joint-sealant manufacturer for joint application indicated and of size
      c. Provide Type density to control sealant depth and otherwise contribute to producing optimum sealant performance:

   2. Type C (closed-cell material with a surface skin)
   3. Type O (open-cell material)
   4. Type B (bicellular material with a surface skin) or

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

   a. Metal.
   b. Glass.
   c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
C. **Masking Tape:** Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

A. **General:** Comply with joint-sealant manufacturer’s written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. **Sealant Installation Standard:** Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. **Acoustical Sealant Application Standard:** Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using 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 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 joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.

3.4 FIELD QUALITY CONTROL

A. Field Inspection:

1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
2. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. General:

1. Refer to Part 2 of this Section for sealant definition.
2. Provide compatible, closed cell backer rod where secondary material not designated.

B. Exterior Joint Sealant Schedule:

1. Wall and Control Joints:
   a. Bounded on one or both sides by stone: U-MC.
   b. Bounded on both sides by porous building material other than stone (concrete, CMU, brick): S-GP.
   c. Bounded on both sides by non-porous building material (coated and uncoated metals, anodized aluminum, and glass): S-GP.
d. Bounded on one side by porous building material (brick, CMU, concrete) and other side by non-porous building material (coated and uncoated metals, anodized aluminum, and glass): S-GP.

2. Bounded on one or both sides by stone dissimilar materials not identified above: U-MC.
3. Perimeter of penetrations through walls: Same as at wall and control joints.
4. Expansion joints in ceilings, soffits, and overhead surfaces: U-MC.
5. Control joints and perimeter of penetrations in ceilings, soffits, and overhead surfaces: U-MC.
6. Wall and ceiling joints between frames and their rough opening: Same as wall and control joints above.
7. Wall and ceiling joints between frames and adjoining surfaces: Same as scheduled at wall joints and control joints above.
8. Joints and perimeter of penetrations in horizontal pedestrian and vehicle traffic surfaces: U-TB.

C. Interior Joint Sealant Schedule Locations:

1. Wall and Ceiling Joints Subject to Movement: U-MC.
2. Wall and Ceiling Joints Not Subject to Movement: AL.
3. Joints at Dissimilar Materials, Not Subject to Movement: AL.
4. Joints at Dissimilar Materials, Subject to Movement: U-MC.
5. Interior Side of Exterior Openings: U-MC.
6. Wall and Ceiling Joints between Frames and Their Rough Opening: AL.
7. Wall and Ceiling Joints between Frames and Adjoining Surfaces: AL.

END OF SECTION 07920
SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Steel doors.
2. Steel door frames.

B. Related Sections include the following:

1. Division 8 Section "Door Hardware" for door hardware and weather stripping.
2. Division 9 Section "Painting" for field painting factory-primed doors and frames.

1.2 SUBMITTALS

A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, and finish.

1.3 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at building site under cover. Place units on wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flush Steel Doors and Frames:
   a. Amweld Building Products, Inc.
   b. Ceco Door Products; a United Dominion Company.
   c. Curries Company.
   d. Republic Builders Products.
   e. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

C. Metallic-Coated Steel Sheets: ASTM A 653, Commercial Steel (CS), Type B, with an A40 zinc-iron-alloy (galvannealed) coating; stretcher-leveled standard of flatness.

2.3 DOORS

A. General: Provide doors of sizes, thicknesses, and designs indicated.

B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 1 and Physical Performance Level C, (Standard Duty), Model 2 (Seamless).

C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 2 and Physical Performance Level B, (Heavy Duty), Model 2 (Seamless).

2. All exterior doors shall have fully insulated core construction.

2.4 FRAMES
A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.

B. Interior Frames: 0.053-inch- thick steel sheet.

C. Exterior Frames 0.067-inch- thick steel sheet.

D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.

E. Plaster Guards: Provide 0.016-inch- thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

F. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.

1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.

G. Inserts, Bolts, and Fasteners: Manufacturer’s standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer’s plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.

B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from galvanized, metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch- thick, metallic-coated steel channels with channe webs placed even with top and bottom edges.

C. 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, unless otherwise indicated.

D. Core Construction: Manufacturer’s standard core construction that produces a door complying with SDI standards.

1. Resin-impregnated kraft/paper honeycomb.
2. Polystyrene.
4. Rigid mineral-fiber board.

E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jamb and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.

F. Clearances for Fire-Rated Doors: As required by NFPA 80.

G. Single-Acting, Door-Edge Profile: Square edge unless beveled edge is indicated.


I. Fabricate concealed stiffeners, reinforcement, edge channels, louver, and moldings from either cold- or hot-rolled steel sheet.

J. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

K. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.

1. Unless otherwise indicated, provide thermal-rated assemblies with U-value of 0.41 Btu/sq. ft. x h x deg F or better.

L. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcement, and provisions for fastening in top rail of doors or head of frames, as applicable.

M. Frame Construction: Fabricate frames to shape shown.

1. Provide knock down frames

N. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

O. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

P. Astragals: As required by NFPA 80 to provide fire ratings indicated.
2.6 FINISHES

A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.

2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.

3. In existing concrete or masonry construction, provide at least three completed opening anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.

4. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.

5. For in-place gypsum board partitions, install knock-down, drywall slip-on frames.

6. Install fire-rated frames according to NFPA 80.

7. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.

C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.

3.2 ADJUSTING AND CLEANING

A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110
SECTION 08710 - HARDWARE

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: For each item.
   1. Include sample of warranty customized for this project.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with NFPA 80 for hardware at fire-rated assemblies.
   1. Provide hardware which has been tested and listed by UL or FM for fire-rated assemblies of types which comply with requirements of door and frame labels.

1.3 WARRANTY

A. Warranty: Manufacturer's warranty stating closers will be free from defects in materials and workmanship for period of five years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. General: Where products are specified by manufacturer to establish standard of quality, function, and design. Products of equivalent quality, function and design are acceptable.

B. Butt Hinges: ANSI A156.1 and A156.7.
   1. Five knuckle design with square corners.
   2. Full mortise type.
   3. Anti-friction or ball bearing type for doors equipped with closers.
   4. Plain bearing type for doors less than 3'-0" width which are not equipped with closers.
   5. 1-1/2 pair on doors up to 7'-6" in height, two pair on doors 7'-6" to 9'-6" in height.
   6. Heavy weight hinges for fire rated doors.
   7. Acceptable Manufacturers:
      a. Hager Hinge Co., St. Louis, MO.
      b. McKinney, Scranton, PA.
      c. Stanley Hardware Division of The Stanley Works, New Britain, CT.

C. Keying: Consult with Owner's authorized representative and prepare detailed keying schedule accordingly.
1. Key to existing system in sets or subsets, masterkey, and grand masterkey as directed.
2. Provide two keys for each lock.

D. Cylinders: Provide cylinders for locksets, deadlocks, exit devices, and other control and locking devices.
   1. Six pin tumbler design.
   2. Equip cylinders with appropriate rings.
   3. Finish cylinders and rings to match trim.

E. Heavy Duty Cylindrical Locksets and Latchsets: ANSI A156.2, 4000 Series, Grade 1.
   1. Acceptable Products: Yale 5400LN Series, heavy duty, of functions indicated in Hardware Sets which corresponds with following designations:
   2. Trim: Lever and rose, Augusta design.

F. Exit Devices: Von Duprin 99 Series touch bar design with 994L lever trim and cored to match building standard.

G. Surface Mounted Closers: ANSI A156.4, Grade 1.
   1. Acceptable Product: LCN 4000 Series
   2. Acceptable Manufacturers:
      a. Dorma Door Controls Inc., Reamstown, PA.
      b. LCN Closers, Princeton, IL.
      c. Norton Door Controls, Charlotte, NC.

H. Coordinators: Ives 900 Series with full width fillers.

I. Wall Stops:
   1. Provide blocking in gypsum board and metal stud partition.
   2. Acceptable Product: Ives 407 or 407-1/2 as applicable equipped with expandable anchor for use at gypsum board/stud walls.
   3. Acceptable Product: Ives 408 or 408-1/2 as applicable equipped with machine screw and expansion shield for use at concrete or masonry walls.

J. Silencers: Preformed neoprene or rubber.

   1. Location and Quantities:
      a. Pairs of Doors: Two at header.
      b. Single Doors: Three at strike jamb.

K. Thresholds: Extruded aluminum.
   1. Size: Width as indicated on Drawings by, 1/2 inch height.

2.2 FINISHES
   A. Except where indicated otherwise in Hardware Sets, provide 626 hardware finish.
   B. Prime coated items will be field painted under Section 09910.

PART 3 - EXECUTION
3.1 INSTALLATION
   A. Install hardware in accordance with HMMA 830, manufacturer's templates and printed instructions, and Project conditions.
      1. Install fire rated hardware in accordance with NFPA 80.
      2. Where cutting and fitting is required on substrates to be field painted or similarly finished, install, fit, remove and store hardware prior to finishing. Reinstall hardware after finishing operations are completed.
      3. Do not install surface mounted items until finishes have been completed on the substrate.
      4. Reinforce attachment substrates as necessary for installation and operation.
   B. For Substrates which are Not Factory Prepared for Hardware:
      1. Mortise work to correct size and location without gouging, splintering or causing irregularities in exposed finish work.
      2. Fit faces of mortised components snug and flush without excessive clearance.
   C. Set thresholds at exterior doors in bed of sealant. Remove excess sealant.

3.2 ADJUSTING
   A. Check and adjust each operating hardware item to ensure correct operation and function.
      1. Lubricate moving or operating components as recommended by hardware manufacturer. Use graphite type lubrication if none other is recommended.
      2. Replace defective materials or units which cannot be adjusted to operate as intended. Reinstall items found improperly installed.
      3. Prior to date of Substantial Completion, readjust and relubricate hardware items as necessary.
3.3 HARDWARE SETS

A. Set H1 – Exterior Penthouse:
   1. Hinges
   2. Heavy Duty Cylindrical Latchset
   3. Wall Stop
   4. Silencers

B. Set H2 Exit Door:
   1. Hinges - Existing
   2. Exit Device with Lever Lockset
   3. Closer - Existing
   4. Silencers - Existing

END OF SECTION 08710
SECTION 09310 - CERAMIC TILE

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. Section Includes:
   1. Ceramic tile.
   2. Stone thresholds.
   3. Waterproof membrane.

B. Related Sections:
   1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.


1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.


C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

D. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Full-size units of each type of trim and accessory for each color and finish required.

E. Qualification Data: For qualified Installer.

1.5 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Waterproof membrane.
   2. Joint sealants.
   3. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site.
   1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards
referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.
2.2 TILE PRODUCTS

A. Unglazed Ceramic Mosaic Tile
   1. Description:
      a. Porcelain body, matte finish, ANSI A137.1, paragraph 5.1, standard grade.
      b. Static Coefficient of Friction: wet 0.60 minimum, dry 0.70 minimum ASTM C1028.
      c. Mounting: Factory back-mounted sheets compatible with wet environment installation.
   2. Dimensions: 1/4 inch thick, grout width 1/8 inch.
   3. Trim Shapes: Base, caps, returns and other trim accessories as required; same characteristics as tile.
   4. Basis-of-Design Product: Subject to compliance with requirements, provide Unglazed Ceramic Mosaic American, Olean; Division of Dal-Tile International Inc. or comparable product by one of the following:
      a. Crossville, Inc.
      b. Daltile, Division of Dal-Tile International Inc.

B. Pool Signage Tile:
   1. Description: Ceramic tile with 4 inch high numbers or symbols to indicate pool depth or hazard warning. Horizontal application.
      a. Depth in feet. As indicated on Drawings.
      b. Depth in inches. As indicated on Drawings.
      c. Symbols, "No Diving with (Red) International Symbol. As indicated on Drawings.
   3. Product: Inlays FT, IN, and MG Series, Inlays Inc., Green Bay, WI.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
   1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Granite Thresholds: ASTM C 615, with polished finish.
   1. Description: Uniform, medium-grained, gray stone without veining.

2.4 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
B. Sheet Membrane for Thin-Set Tile Application: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch (0.76-mm) nominal thickness.

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. Noble Company (The); Nobleseal TS.

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane or comparable product by one of the following:

   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. Custom Building Products.
   d. MAPEI Corporation.
   e. Summitville Tiles, Inc.

2.5 SETTING MATERIALS


1. Portland Cement: ASTM C150, Type I, from one source only, non-staining and non-air-entraining.
3. Setting Bed Sand: ASTM C136, 100 percent passing No. 4 sieve.
4. Latex Additive: Acrylic latex or Styrene Butadiene latex additive serving as replacement for gauging water, for use with site mixed Portland cement mortar.
5. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete 3701 Mortar Admix with Laticrete 226 Thick Bed Mortar Mix, Laticrete International or comparable product by one of the following:

   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. Custom Building Products.
   d. Laticrete International, Inc.
   e. MAPEI Corporation.
   f. Summitville Tiles, Inc.
   g. TEC; a subsidiary of H. B. Fuller Company.
B. Polymer Modified Thin-Set Mortar: Two component system; factory prepared, high bond strength dryset mortar and liquid polymer additive; ANSI A118.4.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete 4237 Mortar Admix with Laticrete 211 Crete Filler, Laticrete International or comparable product by one of the following:
      a. Bonsal American; an Oldcastle company.
      b. Bostik, Inc.
      c. Custom Building Products.
      d. Laticrete International, Inc.
      e. MAPEI Corporation.
      f. Summitville Tiles, Inc.
      g. TEC; a subsidiary of H. B. Fuller Company.

2.6 GROUT MATERIALS

A. Latex-Modified Grout:
   1. Sanded latex-modified, factory blended, mildew resistant, grout consisting of portland cement, graded quartz and additives; ANSI A118.6.
   2. Liquid Latex Additive: Acrylic latex or Styrene Butadiene latex additive in liquid-latex form for addition to prepackaged dry-grout mix.
   3. Minimum Compressive Strength: 210 kg/cm² (3000 psi).
   4. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete International, Inc. Laticrete 2500 Series Permacolor or comparable product by one of the following:
      a. Bonsal American; an Oldcastle company.
      b. Bostik, Inc.
      c. Custom Building Products.
      d. MAPEI Corporation.
      e. Summitville Tiles, Inc.

2.7 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 7 Section "Joint Sealants."
   1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
C. Multipart, Purable Urethane Sealant for Use: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

1. Products: Subject to compliance with requirements, provide one of the following:
   b. Degussa Building Systems; Sonneborn Sonolastic SL 2.
   c. Pecora Corporation; NR-200 Urexpan.
   d. Sika Corporation; Sikaflex-2c SL.
   e. Tremco Incorporated.; THC-900 or THC-901.

2.8 MISCELLANEOUS MATERIALS

A. Waterproofing Membrane:
   2. Compliant with ANSI A118.10
   3. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete International, Inc. Laticrete 1500 Series Tri-Poly Fortified Sanded Grout mixed with Laticrete 1776 Grout Admix Plus or comparable product by one of the following:
      a. Bonsal American; an Oldcastle company.
      b. Bostik, Inc.
      c. Custom Building Products.
      d. MAPEI Corporation.
      e. Summitville Tiles, Inc.

B. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185 and ASTM A 82 except for minimum wire size.

C. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.
   1. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
   3. Configuration over Studs and Furring: Flat.
   5. Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m).

D. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

E. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with
tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.

2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

F. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

G. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.


2. Acceptable manufacturers:
   a. Bonsal American; an Oldcastle company.
   b. Bostik, Inc.
   c. Custom Building Products.
   d. MAPEI Corporation.
   e. TEC; a subsidiary of H. B. Fuller Company.

2.9 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile swimming pool decks.
B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).

F. Expansion Joints: Comply with TCA EJ171.

1. General: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

2. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
3. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

G. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

3.4 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-Portland cement grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only
cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Installations:

1. I-1, Tile Installation P601: Swimming Pool, cement mortar bed (thickset) bonded to concrete; TCA F112 and ANSI A108.1A.
   a. Tile Type: As noted on Drawings.
   b. Waterproof membrane.
   c. Thin-set Bond Coat
   d. Thickset
   e. Thin-set
   f. Grout: Polymer-modified.
   g. Grout sealer

2. I-2, Tile Installation F113: Thin-set mortar; TCA F113.
   a. Tile Type: As noted on Drawings.
   b. Thin-Set
   c. Polymer-modified grout.
   d. Grout sealer

   a. Tile Type: As noted on Drawings.
   b. Thin-Set
   c. Polymer-modified grout.
   d. Grout sealer

END OF SECTION 09310
SECTION 09851 – SOUND ABSORBING PANELS

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:
   1. Encapsulated wall and hung panel systems shown on the Drawing.
   2. Replacement panels to match existing acoustical panels.

1.3 SUBMITTALS
A. Manufacturer’s Literature and Data:
   1. Product Data: Submit manufacturer’s technical data and brochures for each type of specified system required. All products furnished shall have a flame spread classification of 0-25 for a Class A rating in accordance with ASTM E-84.
B. Shop Drawings: Show dimensions, sizes, thickness, finishes, accessories, attachments, and mounting to adjoining work.
C. Samples: 12" x 8" piece of each type of encapsulated material and covering as specified and accessories.
D. Certifications: Submit certification from manufacturer of wall panels and baffles attesting that products comply with specified requirements including finish as specified.
E. Qualification Data: Firms specified in "Quality Assurance" Article must demonstrate their capabilities and experience by including lists of completed projects names and addresses, names and addresses of architects and owners, and other information specified.

1.4 DELIVERY, STORAGE & HANDLING
A. Protection: Protect material during fabrication, shipment, site storage and erection to prevent damage to the finished work from other trades. Store panels or baffles inside a well-ventilated area, away from uncured concrete and masonry, and protected from the weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.5 WARRANTY
A. Special Warranty: Manufacturer agrees to repair or replace components of sound-absorbing ceiling units that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Acoustical performance,
   2. Fabric sagging, distorting, or releasing from panel edge.
   3. Warping of core.
B. Warranty Period: Two years from date of Substantial Completion.

PART 2 – PRODUCTS
2.1 PVC PANELS
   A. System Description: Wall and suspended panel systems to include panels, trim and accessories as complete package.
   
   B. Acoustical Systems:
      1. Suspended Panels
      2. Wall Panels
   
   C. Manufacturers
      2. Conwed Designscape; an Owens Corning Company.
      3. Decoustics Limited; a CertainTeed Ceilings Company
   
   D. Product size: As indicated on Drawings
   
   E. Fiberglass Core Thickness: 2 inch.
   
   F. Fiberglass Core Density: 3 pounds.
   
   G. Mounting Accessories:
      1. Hung panel application: Manufacturer's standard Cable Crimp Sleeves, Turnbuckles, Wire Hanger Clips, Beam Clamps, Aircraft Cable, and Nylon Tie Wrap.
      2. Wall mounted applications: Manufacturer's standard panel grommets and mechanical fasteners.
   
   H. Acoustical Qualities
      1. Finished Acoustical Wall Panels as specified shall provide a NRC (Noise Reduction Coefficient) of 0.65 to 1.15. Baffle Products shall provide an acoustical performance of 12.37 Sabins/baffle at 500 Hz for standard 2' 4' baffle.
      2. All material furnished shall be tested in accord with ASTM C-423 for Sound Absorption. Test results shall be furnished for mounting selected.
   
   I. Facing: Polyvinyl Chloride (PVC), 4.0 mil.
      1. Non-combustible, class A in accordance with ASTM E-84.
      2. Color: To be selected by Architect from standard range of product colors available.

2.2 PAINT FINISHED PANELS
   
   A. Products and Manufacturers
      1. Basis of design: New Dimensions Acoustical Wall Panels as manufactured by Wall Technolgy, Ladysmith, WI.
      2. Conwed Designscape; an Owens Corning Company.
      3. Decoustics Limited; a CertainTeed Ceilings Company
B. Panels Construction: Composite core construction of dimensionally stable rigid fiberglass of 6-7 pcf density laminated to 1/16" 16-20 pcf molded glass fiber.
   1. Thickness: 2 inches.
   2. Sizes: 12 inches by 12 inches.

C. Edge Profile: Square.

D. Corner Detail: Square.

E. Edge Treatment: Resin hardened

F. Panel Finish: Manufacturer’s standard paintable surface.
   1. Finish shall be applied directly over the face and edges of the panel to provide a full finished edge. All corners are fully tailored.

G. Mounting: Impaling / Adhesive,

H. Acoustical Performance NRC of 0.85 minimum in accordance with ASTM C-423 (Type “A” Mounting).

I. Flammability: All panel components, Class “A” flame spread rating of 25 or less in accordance with ASTM E-84.

2.5 FABRICATION
A. General: Use manufacturer’s standard construction except as otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warping and damage.

B. Facing Material: Apply fabric facing fully covering visible surfaces of unit; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter. Provide heat seal vinyl fabric seams at corners.

C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch for the following:
   1. Thickness.
   2. Edge straightness.
   3. Overall length and width.
   4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine building structure to receive acoustical system for irregularities that would affect quality and execution of work.

B. Tolerance: Install ceiling systems with maximum permissible deflection of L/360 of span maximum surface deviation of 1/8" in 4'-0" (no load applied) ASTM635-92.
3.2 INSTALLATION

A. General: Comply with manufacturer’s printed instructions, governing regulations for Seismic Codes, and with the Ceiling Interior Systems Construction Assoc. (CISCA) standards applicable to work.

B. Install sound-absorbing wall units in locations indicated with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

C. Installation Tolerances:
   1. Variation from Alignment with Surfaces: Plus or minus 1/16 inch.
   2. Variation from Level or Slope: Plus or minus 1/16 inch.

D. Space Enclosure: Do not install any work until space is enclosed and weather proofed, wet-work in space is completed and nominally dry, work above ceilings is complete, and temperature and humidity is continuously maintained at values near those of final occupancy.

3.3 CLEANING

A. Clean all surfaces following installation.

B. Replace units having tears, abrasions, or other defects, with unblemished panels, or suspension.

C. Maintain per manufacturer’s finish maintenance instructions.

END OF SECTION 09851
SECTION 09910 – PAINTS

PART 1 - GENERAL

1.1 SYSTEM REQUIREMENTS
   A. Application Requirements: Apply scheduled paints to exposed surfaces of items and spaces unless specifically indicated otherwise.

1.2 SUBMITTALS
   A. Color Charts: Submit manufacturer's standard color chips and charts for use in preparation of Color Schedule.

1.3 QUALITY ASSURANCE
   A. Single Source Responsibility: Provide products of single manufacturer for use in each paint system. Do not mix products of different manufacturers without approval of Architect and manufacturers involved.
   B. Applicator Qualifications: Company specializing in commercial painting and finishing with three years experience.

1.4 FIELD SAMPLES
   A. Sample Installation: Duplicate finishes of approved paint system samples on wall surfaces and other interior and exterior components selected by Architect.
   B. Provide full-coat finish on at least 100 square feet or 10 lineal feet of surface until required color, sheen, and texture are obtained. Simulate finished lighting conditions for review of in-place work.
   C. Request review by Architect of first finished room, space, or item for each paint system for color, texture, quality, and workmanship before proceeding with rest of Work.
   D. Accepted Field Sample: May remain part of completed Work.

1.5 PROJECT CONDITIONS
   A. Comply with manufacturer's requirements under which systems can be stored and applied.
   B. Take precautionary measures to prevent fire hazards and spontaneous combustion.

PART 2 - PRODUCTS

2.1 PAINTS
   A. Acceptable Manufacturers:
      1. Benjamin Moore, Montvale, NJ.
      2. ICI Paints and ICI Devoe Coatings, Cleveland, OH.
      3. PPG Industries, Pittsburgh, PA.

2.2 FILLERS AND SEALERS
   A. Paste Wood Filler:
      1. Benjamin Moore: Benwood No. 23805
   B. Sanding Sealer (Vinyl Toluene Copolymer):
2. ICI Paints: Woodpride Interior Quick Dry Sanding Sealer No. 1916.
4. PPG: Speedhide Alkyd Sanding Sealer, 6-10.

2.3 PRIMERS
A. Alkali Resistant Primer:
B. Benjamin Moore: Moore’s Latex Quick Dry Prime Seal No. 201-00.
D. PPG: Alkali Resistant Primer No. 6-3.
E. Galvanized Primer:
F. PPG: Galvanized Steel Primer No. 6-209.

2.4 SOLVENT REDUCIBLE PAINTS
A. Medium-Oil Alkyd Enamel:
   1. Benjamin Moore: Ironclad Quick Dry Industrial Enamel No. 071.
   2. ICI/Devoe Paints: Devguard Alkyd Gloss Enamel No. 4308.

2.5 WATER BASED PAINTS
A. Industrial Acrylic:
   1. PPG: Water Base Inhibitive Primer No. 6-712.
   3. Tnemec: Tneme-Cryl Series 6 (Flat) and Series 7 (Semi-gloss).

2.6 TRANSPARENT FINISHES
A. Polyurethane Varnish:
   1. Benjamin Moore: Benwood Polyurethane Finishes No.424 (Flat), 435 (Satin), and 428 (Gloss).
   2. ICI Paints: Woodpride Clear Varnish No. 1902 (Satin) and 1908 (Gloss).
   3. PPG: Rez Polyurethane Varnish No. 77-9 (Satin), 77-5 (Gloss).

2.7 MIXING
A. Use factory prepared colors matching approved samples. Site tinting not allowed.
B. Thoroughly mix and stir paints before use to ensure homogeneous dispersion of ingredients.
C. Apply coats of consistency recommended by manufacturer. Thin only within recommended limits using thinners approved by paint manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION
A. Examination: Measure moisture content of substrates using recently calibrated electronic moisture meter. Do not apply paints if moisture content of surfaces exceeds lesser of percentages listed below or those required by paint manufacturer.
B. Preparation: Remove surface hardware, mechanical diffusers, escutcheons, registers, electrical plates, light fixture trim, fittings, fastenings and similar items prior to preparing surfaces for finishing. Provide surface-applied protective masking for non-removable items. Carefully store removed items for reinstallation.

C. Prior to application of paints, ensure surfaces are clean, dry, and free of dirt, dust, rust or rust scale, oil, grease, mold, mildew, algae, efflorescence, release agents, and other foreign material which could adversely affect paint adhesion and finished appearance.

D. Previously Coated Surfaces: Test compatibility of existing coatings by applying new paint to small, inconspicuous area. If new paints lift or blister existing coatings, request recommendation from Architect.

3.2 APPLICATION
A. Paints: Apply products in accordance with manufacturer's instructions. Use application materials, equipment, and techniques as recommended by paint manufacturer and best suited for substrate and type of material being applied.

B. Apply material at not less than manufacturer's recommended spreading rate. Do not exceed maximum single coat thickness recommended by paint manufacturer.

C. Ensure that edges, corners, crevices, and exposed fasteners receive dry film thickness equivalent of flat surfaces.

D. Finish edges of paints adjoining other materials and colors sharp and clean, without overlapping.

3.3 CLEANING AND PROTECTION
A. Cleaning: Promptly remove spilled, splashed, or spattered paints. Clean spots, oil, and other soiling from finished surfaces using cleaning agents and methods which will not damage materials.

B. If completed construction is damaged beyond normal cleaning or repair by painting operations, replace damaged items at no additional cost to Owner.

C. Protection: Protect work of other trades against damage from painting activities. Correct damage by cleaning, repairing, replacing, and repainting as acceptable to Architect.

D. Provide WET PAINT signs and other methods to protect newly coated surfaces. Remove when directed or when no longer needed.

3.4 FINISH PAINTING SCHEDULE
A. General:
   1. Prime Coat: Manufacturer's required, unless noted otherwise.
   2. Dry Film Thickness: Manufacturer's required, unless noted otherwise.

B. Paint System No. 1 (Alkyd Finish):
   2. Sheen: Flat.
   3. Prime Coat: Alkali Resistant Primer at 1.5 mils.
   4. Under Coat: Medium-Oil Alkyd Enamel at 2.0 mils.
   5. Top Coat: Medium-Oil Alkyd Enamel at 2.0 mils.
   6. System DFT: 5.5 mils.

C. Paint System No. 2 (Clear Polyurethane Finish):
   1. Surface: Transparent interior wood benches.
   2. Sheen: Gloss.
   3. Stain: None.

D. Paint System No. 3 (Latex Finish):
2. Sheen: Eggshell.
3. Prime Coat: Galvanized Primer at 2.0 mils.
5. Top Coat: Industrial Acrylic at 3.0 mils.

END OF SECTION 09910
SECTION 09960 - SPECIAL COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coating systems for natatorium. Coating system for interior previously coated CMU walls and acoustic treated ceiling.

1.2 REFERENCES


B. ASTM D 4263 - Indicating Moisture in Concrete by the Plastic Sheet Method.

C. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

D. ICRI Guideline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

E. SSPC-SP 1 - Solvent Cleaning.

F. SSPC-SP 6/NACE 3 - Commercial Blast Cleaning.

G. SSPC-SP 13/NACE 6 - Surface Preparation of Concrete.

1.3 DEFINITIONS

A. Definitions of Painting Terms: ASTM D 16, unless otherwise specified.

B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.4 SUBMITTALS

A. Product Data: Submit manufacturer’s product data for each coating, including generic description, complete technical data, surface preparation, and application instructions.

B. Color Samples: Submit manufacturer’s color samples showing full range of standard colors.

C. Manufacturer’s Quality Assurance: Submit manufacturer’s certification that coatings comply with specified requirements and are suitable for intended application.

D. Applicator’s Quality Assurance: Submit list of a minimum of 5 completed projects of similar size and complexity to this Work. Include for each project:
1. Project name and location.
2. Name of owner.
3. Name of contractor.
4. Name of architect.
5. Name of coating manufacturer.
6. Approximate area of coatings applied.
7. Date of completion.

E. Field Quality Control Report: Submit report as required by Part 3 of this Section.

1.5 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Specialize in manufacture of coatings with a minimum of 10 years successful experience.
2. Able to demonstrate successful performance on comparable projects.

B. Applicator's Qualifications:

1. Experienced in application of specified coatings for a minimum of 5 years on projects of similar size and complexity to this Work.

C. Preapplication Meeting: Convene a pre-application meeting 2 weeks before start of application of coating systems. Require attendance of parties directly affecting work of this section, including Contractor, Construction Manager, applicator, and manufacturer's representative. Review the following:

1. Environmental requirements.
2. Protection of surfaces not scheduled to be coated.
4. Application.
5. Repair.
6. Field quality control.
7. Cleaning.
8. Protection of coating systems.
9. One-year inspection.
10. Coordination with other work.
1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying:

1. Coating or material name.
2. Manufacturer.
3. Color name and number.
4. Batch or lot number.
5. Date of manufacture.
6. Mixing and thinning instructions.

B. Storage:

1. Store materials in a clean dry area and within temperature range in accordance with manufacturer's instructions.
2. Keep containers sealed until ready for use.
3. Do not use materials beyond manufacturer's shelf life limits.

C. Handling: Protect materials during handling and application to prevent damage or contamination.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
5. Wind: Do not spray coatings if wind velocity is above manufacturer's limit.

B. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with manufacturer's instructions.

C. Dust and Contaminants:

1. Schedule coating work to avoid excessive dust and airborne contaminants.
2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.
PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of design: Tnemec Company Incorporated
B. Other acceptable manufacturers:
   1. Sherwin Williams
   2. ICI Paints
   3. Carboline Company, St. Louis, MO.

2.2 PREVIOUSLY PAINTED – ACCOUSTIC TREATED CONCRETE CEILINGS

A. Type SC-1, Moderate Exposure, Concrete Masonry Units and Concrete:
   1. System Type: Mildew-resistant specialized elastomeric waterborne acrylate.
   5. Finish Coat: Series 158 Bio-Lastic. DFT 6.5 to 7.5 mils.
   6. Total DFT: 14.0 to 17.5 mils.
   7. Finish Color: To match Architect’s sample.

2.3 PREVIOUSLY PAINTED- CMU WALLS

A. Type SC-2, Concrete, Plaster, and Wood:

   1. System Type: Waterborne Acrylic Epoxy
   2. Surface Preparation: Clean and dry.
   3. Primer: Series 151-1051 Elasto-Grip FC. DFT 1.0 to 1.5 mils.
   4. Intermediate Coat: Series 113 (satin) or 114 (gloss) H.B. Tneme-Tufcoat. DFT 2.5 to 3.0 mils.
   5. Finish Coat: Series 113 (satin) or 114 (gloss) H.B. Tneme-Tufcoat. DFT 2.5 to 3.0 mils.
   6. Total DFT: 6.0 to 7.5 mils.
   7. Finish Color: To match Architect’s sample.

2.4 ACCESSORIES

A. Coating Application Accessories:
   1. Accessories required for application of specified coatings in accordance with manufacturer’s instructions, including thinners.
   2. Products of coating manufacturer.
PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which coating systems are to be applied. Notify Construction Manager of areas or conditions not acceptable. Do not begin surface preparation or application until unacceptable areas or conditions have been corrected.

3.2 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.

B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.3 SURFACE PREPARATION OF PREVIOUSLY PAINTED CMU WALLS & CONCRETE ACOUSTIC TREATED CEILINGS

A. Prepare surfaces in accordance with manufacturer's instructions.

B. Ensure surfaces are clean, dry, and free of oil, grease, dirt, dust, and other contaminants.

C. Remove all loose paint and feather paint edges.

3.4 APPLICATION

A. Apply coatings in accordance with manufacturer's instructions.

B. Mix and thin coatings, including multi-component materials, in accordance with manufacturer's instructions.

C. Keep containers closed when not in use to avoid contamination.

D. Do not use mixed coatings beyond pot life limits.

E. Use application equipment, tools, pressure settings, and techniques in accordance with manufacturer's instructions.

F. Uniformly apply coatings at spreading rate required to achieve specified DFT.

G. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.

H. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.5 REPAIR
A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.

B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Reccoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.

C. Coating Defects: Repair in accordance with manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide technical assistance and guidance for surface preparation and application of coating systems.

1. Verify coatings and other materials are as specified.
2. Verify surface preparation and application are as specified.
3. Verify DFT of each coat and total DFT of each coating system are as specified using wet film and dry film gauges.
4. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.
5. Report:
   a. Submit written reports describing inspections made and actions taken to correct nonconforming work.
   b. Report nonconforming work not corrected.
   c. Submit copies of report to Construction Manager and Contractor.

3.7 CLEANING

A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.8 PROTECTION OF COATING SYSTEMS

A. Protect surfaces of coating systems from damage during construction.

END OF SECTION 09960
SECTION 13150 - SWIMMING POOL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The Owner has determined that the nature of the proposed swimming pool construction make the requirement for proper and adequate experience of paramount importance. This section of these specifications describe swimming pool renovation which must be performed by a specialty contractor/subcontractor, herein referred to generically as Pool Contractor, who, under their own name, shall be capable of meeting all pool construction or renovation experience qualifications herein stated, and who is an experienced Swimming Pool Contractor specializing in commercial, municipal and/or institutional swimming pool construction, renovation, equipment installation and service. All work called for in this specification division shall be and will remain throughout the warranty period, the sole responsibility of a single contractor specializing in the construction or renovation of institutional swimming pools and the installation and service of institutional swimming pool equipment.

B. Experience and construction qualifications must be specific to the Swimming Pool Contractor, not to said Contractor’s vendors, subcontractors or employees.

C. It is the intent of these specifications that the Pool Contractor delivers a complete and operational swimming pool with its associated mechanical support systems. New work shall include all control valves as hereinafter specified, and all customary or necessary accessories including plumbing components whether or not shown or implied on the drawings. Any item of new work or equipment obviously a part of or related to the pool structure renovation, the filter system, the water chemistry system and/or necessary to their operation but not specifically mentioned herein or on the drawings shall be furnished by this Contractor at no extra cost.

D. By bidding on this project, the Pool Contractor acknowledges that it thoroughly examined the bid documents, that it understands the expressed design intent, that it acknowledges the feasibility of the design intent as expressed and that it has sufficient knowledge, experience and background to execute the renovation detailed on the project drawings in substantial compliance with the expressed design intent.

1.2 QUALIFICATIONS OF SWIMMING POOL CONTRACTOR

A. The Swimming Pool Contractor must have a proven record of competence and experience in the construction or renovation of similar, municipal and/or institutional facilities. The following requirements have been established to insure that only properly qualified Contractors will be considered.

B. Documentation establishing the following minimum experience must be submitted by each Pool Contractor.
1. Pool Contractor's certification that it has been continuously engaged for the past ten (10) years in the construction or renovation of institutional swimming pools.

2. Pool Contractor's project experience listing shall include at least ten (10) indoor, institutional swimming pools with a water surface area of not less than 3,000 sq ft., which the Pool Contractor has built or renovated in a manner comparable to the renovation described herein.

3. Reference projects must have be within 100 miles of the proposed project site.

C. The Engineer and/or Owner reserves the right to reject any Pool Contractor if the evidence submitted by, or investigation of, such Pool Contractor fails to satisfy the Engineer/Owner that such Pool Contractor is properly qualified to carry out the obligations of the contract and to complete the work described, or if the Contractor does not meet the minimum qualifications stated above and herein.

1.3 SUBSTITUTIONS

A. It is the intent of these specifications that the base bid shall be based upon furnishing the materials and equipment specified herein. The Engineer and Owner have made a detailed investigation before selecting the specified swimming pool equipment and renovation method. The operation and maintenance of the swimming pool facility, sustainable design attributes, the interface of related equipment within the building structure, and governmental approvals specific to this project are predicated upon utilization of the equipment identified as the basis for design.

B. The materials, products and equipment described in the bidding documents establish a standard of required function, design, appearance and quality to be met by any proposed substitution. Contractors wishing to bid based upon the use of components or methods of renovation other than those specified may refer to the section describing procedures for product substitution. In such an event, bidders are strongly encouraged to submit their proposed substitution at least 10 days prior to the bid date.

C. Bidders who propose substitutions shall be responsible for the integration of such substitution into the overall construction. The Engineer/Owner reserves the right to required sealed drawings detailing any such required changes as a prerequisite to their consideration of a proposed substitution.

D. In the event the Engineer / Owner shall not accept any proposed substitution, then the Contractor shall be required to furnish the materials specified at no extra cost to the Owner.

E. Equivalent products, whether named or not, must satisfy the design intent expressed by the project drawings or specifications. The contractor shall assume all design responsibilities or costs associated with the use of products other than the basis for design.

1.4 SCOPE OF WORK
A. The Contractor shall provide all labor, material, equipment and services required for installation of all items of work specified herein. It is understood that the intent of the said plans and specifications is to require the Contractor to furnish a pool ready for use.

B. Water to fill and/or test the pool, and any other pool related items specifically excluded from the work of this section, by these specifications or as noted on the drawings shall be by the Owner or others.

C. Base Bid Work of this Section:

In general, the work of this section includes but is not necessarily limited to the following:

1. Remove existing vacuum pump and related piping as shown on project drawings. Cap or plug remaining vacuum ports or pipes. Provide new automatic robot cleaner with any required accessories to allow manual operation.
2. Perform selective demolition of the existing pool structures for new main drains.
3. Provide and install, connect and grout around new VGB-compliant stainless steel bottom drains/grates and grout into existing shell.
4. Coordinate new main drains with new pool tile work specified elsewhere in these specifications.
5. Coordinate pool bonding with work under Division 16.
6. Provide and install new medium pressure UV system.
7. Provide any incidental low-voltage control wiring (less than 110 volts)
8. Demolish and remove existing make-up water fill tank and any related exposed piping. Provide and install new automatic water level control system including new balance tank probe chamber and make-up water connection to effluent side of RPZ valve. (RPZ valve provided by Division 15)
9. Provide initial start-up of the pool, balancing of pool water, initial chemical inventory, instructions to the Owner's personnel and written instructions on the proper operation of the new pool equipment.
10. Provide shop drawings on construction, equipment layout for approval.

D. Related and interfacing work:

The following related work is not included in the work of this section and may be further defined or specified in other sections of these specifications.

1. All work involving domestic water lines including domestic water RPZ valve or handicapped lift as required and noted.
2. All work pertaining to the pool dehumidification system including interconnecting piping between filter system and dehumidification system shall be by other trades.
3. Ceramic tile demolition or replacement either on the pool decks or within the pool structures.
4. Electrical work: All electrical work including power and control wiring, conduits, disconnects, power panels and breakers, etc., to make system
operational, grounding of the pool, deck equipment anchorage, and filter room equipment are not included in the work of this section. The work of this section does include the provision of the solenoid valves, water chemistry equipment, specialized control panels (specific to pool equipment), and the mounting of such equipment.

5. Reasonable and efficient site access for work crews and heavy equipment are not included in the work of this section.

6. Water and electricity, as required, shall be provided by the Owner/Others during pool construction and testing.

7. All related general construction work not called for in pool specifications but specified and noted on the project drawings is not included in the work of this section.

1.5 QUALITY OF MATERIAL

A. Special attention is directed to the specifications and/or drawings relative to materials and equipment specified in this Division.

B. Where more than one manufacturer's name is mentioned or the term "or equal" is used, a particular item of equipment or material, the Contractor may base its bid on other manufacturers, but will be subject to Engineer's approval per Instructions to Bidders.

1.6 TESTING

A. Unless otherwise provided by the owner or owner's representative, the Contractor shall be responsible for the following test procedures in accord with procedures described in ACI 506.2.

1. Piping

   a. Any pressure lines shall be air tested at 20 psi and shall hold the desired pressure for a period of two (2) hours. In case of pressure loss exceeding 1 psi in two (2) hours, all joints shall be checked with a soapy solution to determine if leaking. Leaking joints shall be repaired and the system rechecked until all joints in piping are proven to be satisfactory.

   b. Any new piping systems normally operated at static or negative pressure (suction) shall be tested at 10 psi for a period of two (2) hours. In case of pressure loss exceeding 1 psi in two (2) hours, all joints shall be checked and repaired if faulty.

1.7 CONSTRUCTION TOLERANCES

A. The Contractor shall be responsible for the following tolerances:

1. The pool dimensions shall match the existing dimensions.
1.8 WARRANTY & GUARANTEE

A. The following warranties shall apply to all work under this contract specific to the Swimming Pool:

1. One (1) year contractual warranty
   a. The Contractor shall warrant that all materials used in the completing the installation contracted for are new and of high quality; that all work has been done in a competent and workmanlike manner; that if any substantial defect occurs in the workmanship or materials it will be remedied without cost to the Owner if written notice is given to the Contractor within one (1) year after the performance of such work and within ten (10) days of evidence of the defect. Assemblies or units (such as heaters, pumps and motors etc.) and standard fittings or accessories purchased by the Contractor for use in this installation are subject only to the extent of the manufacturer's warranty. The foregoing agreement in respect to warranties is in lieu of all other warranties or guarantees, expressed, implied or statutory except Extended Warranties, if called for in the detailed pool specifications.
   b. The integrated chemistry controller (alternate) shall be covered by a standard manufacturer warranty of five (5) years. Special extensions of more limited warranties shall not be considered acceptable. All sensors will be covered by a standard one (1) year warranty. Other parts shall be covered by their own manufacturer's warranty. The controller shall not require a service technician for annual calibration, seasonal start up, or whenever chemicals supplier or type are changed.
   c. The medium pressure ultra violet light disinfection equipment shall be warranted in writing that when operated and maintained according to the manufacturer's operating instructions provided and accepted, it will perform in complete accord with these specifications. All components (excluding the UV arc tube) have a limited warranty to be free from defects in workmanship and materials for a period of 12 months from date of start-up or 18 months from date of shipment, which ever occurs first. UV arc tubes are warranted to operate for 8000 hours when operated continuously. A continuously operated UV arc tube that fails prior to 4000 hours of operation shall be replaced free of charge. A prorated replacement charge will be made for failure from 4000 to 8000 hours of continuous operation. Intermittently operated UV arc tubes (>1 on/off cycle per day) will be replaced free of charge should failure occur prior to 2000 hours and prorated between 2000 and 4000 hours. All warranty replacements are FOB point of shipment.
   d. It is specifically understood and agreed that no claims may be filed under this warranty or the Extended Warranty, and no obligation to make adjustment thereto will accrue until the full indebtedness of the Owner to the Contractor is satisfied.
2. Period of Time:

   a. Period of time of guarantee, warranties and/or maintenance bonds, notwithstanding anything contrary in Contract documents, shall commence with and include date of final certificate of payment, date of issuance of temporary or final certificate of occupancy to Owner, or beneficial occupancy, whichever is earliest. Beneficial occupancy in connection with this article is defined as actual use of premises by Owner for purpose intended.

1.9 SUBMITTALS

   A. Manufacturer's Data: Submit manufacturer's specifications and installation instructions for the complete swimming pool system, and for each component and product used in the system. Include certified laboratory test reports on components as specified or required by regulatory agencies.

   B. Shop Drawings: Wherever deviating from the basis of design, submit shop drawings for the swimming pool system and all its components, including typical details of pool shell, equipment anchors, floor and wall markings drawn at large scale. Submit smaller scale drawings of the overall plan and sections. Include piping and wiring diagrams for recirculation, filtration and chemical treatment systems.

   C. Maintenance Manuals: Submit bound maintenance manuals for swimming pool system. Include full maintenance and operating instructions, part lists, recommended spare parts and emergency parts inventory, chemical treatment and supply list and recommended stock, sources of purchase and similar information.

   D. Refer to section 01330 for quantities of submittal documents and other related information.

1.10 START-UP SERVICES

   A. The Contractor shall supply the services of an experienced swimming pool operator/instructor for not less than one 4-hour instructional period to instruct and familiarize Owner's personnel on the use and operation of the new pool equipment.

   B. The instructor shall issue an agenda of items included in the instruction session.

   C. The owner may request up to three sessions at no additional charge. Requests by the owner for a second or third session must include specific subject(s) to be reviewed or discussed.

1.11 PATENTED MATERIALS
A. The Contractor shall pay all royalties and license fees. The Contractor shall also defend all suits or claims for infringement of any patent rights and shall save the Owner, Engineer and/or Owner's Representative harmless from loss on account thereof. Except that the Contractor shall not be responsible for all such loss when a particular manufacturer or manufacturers is specified, but if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent. The Contractor shall be responsible for such loss unless he promptly gives such information to the Owner, Engineer and/or Owner's Representative.

1.12 CODES

A. All work in this division shall be according to all applicable Local, State and National codes and regulations.

1.13 JOB COORDINATION

A. All Contractors are cautioned to clearly understand the limits of responsibility as detailed in these specifications. Prior to a work start, a meeting shall be held at the jobsite to establish work limits, job schedule and liaison among the Prime Contractor, Sub-Contractors, and the Owners Representative to ensure a coordinated construction process.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF WORK

A. The Contractor shall furnish and install stainless steel main drain boxes with stainless steel grates and flanged connections as shown on the drawings.

B. All below-grade flange fasteners shall be stainless steel.

2.2 PRODUCT REQUIREMENTS

A. Main drain boxes, grating, and piping shall be sized to accommodate 100 % total recirculation rate.

B. Velocities through grating not shall not exceed 1.5 fps.

C. Grating shall not have openings greater than one-half inch.

D. New piping connecting main drains and balance header/tank/filter shall be PVC, schedule 80.

E. Grates shall be flush with the adjacent tile surfaces and constructed of type 304L or 316 stainless steel, non-removable without the use of tools. Grates which extend above the sump frame and adjacent tile finish shall not be considered as meeting the project requirements.
F. Grates must be listed with a 10-year inspection cycle and no limit on life expectancy.

G. Main drain sumps shall be constructed of type 304L or 316 stainless steel with flanged connection for reconnection to existing piping

H. Main drain sumps and gratings shall be compliant with the Virginia Graeme Baker Act and ASME Code A112.19.8-2007.

I. Basis of design are Paddock models as noted on the drawings or equal.

2.3 GROUT

A. The void around the new main drains shall be filled with a non-shrink grout. This grout shall be comprised of 8 bags Portland cement mixed with 3000 lbs. of washed concrete sand. To this mixture add a non-metallic expansive additive similar in performance to Interplast N manufactured by the Sika Chemical Corporation of Passaic, NJ, or approved equal. This material shall be utilized into each yard of grout material placed.

B. before placing grout, the contact surfaces shall be thoroughly cleaned and any steel reinforcing disturbed during demolition shall be replaced where it does not conflict with new drains. grout shall be rodded and puddled to insure complete filling of all voids

2.4 INTERCONNECTING PIPING

A. Any item of equipment or materials obviously a part of the new portions of the pool recirculation systems and necessary to proper operation, but not specifically mentioned in the specifications or shown on the drawings shall be furnished and installed by the Contractor as part of his work at no extra cost to the Owner.

B. Workmanship - All materials to be used in this work shall be installed by workmen thoroughly skilled in their trade and all work shall present a neat and mechanical appearance when complete.

2.5 PIPING MATERIALS

A. Underneath Pool Shell - Piping shall be Schedule 80 polyvinyl chloride (PVC) plastic pipe with similar fittings.

B. Outside Pool Shell - Piping shall be Schedule 80 polyvinyl chloride (PVC) plastic pipe with similar fittings.

2.6 FILTER CONNECTION PIPING

A. All piping within the confines of the filter room including the piping which connects the filter to the filter pump, the recirculation piping, backwash piping, and other drain piping shall be of polyvinyl chloride (PVC), Type 1-1220, Schedule 80 IPS.
2.7 FITTINGS

A. Fittings for plastic pipe shall be of schedule of plastic pipe required and shall govern schedule of fittings utilized. Fit of fittings and pipe shall be proper and capable of developing full strength of the piping system.

2.8 VALVES

A. Small Valves - valves up to and including two (2) inches in size shall be PVC ball valve as manufactured by Spears, Hayward, GS Sloan, or approved equal.

B. Large Valves - valves three (3) inch and larger shall be butterfly wafer valves equal to "Asahi" "Dominion" or "Bray" Series 30-106, bronze disc, stainless steel stem, buna N seat, gear or lever operated as shown.

C. Buried Valves - valves which are placed below grade shall be suitable for use intended and shall be as manufactured by "Kennedy", "Star" or approved equal.

D. Valve Extension Stem and Keys - where required, the Contractor shall furnish and install valve extension stem and/or keys. Keys and extensions shall be as manufactured by Spears, Hayward, GS Sloan, or approved equal.

2.9 AUTOMATIC WATER LEVEL CONTROL SYSTEM

A. The Contractor shall remove the existing make-up water fill tank along with any related exposed process piping and dispose of same off site. Existing domestic water piping can be left in place if it does not interfere with tank removal.

B. The Contractor shall furnish and install an automatic water level control unit as herein specified and as noted on the project drawings.

C. The automatic water level controller assembly shall be a microprocessor based system designed to maintain the water level to within 1/8" of desired level.

D. The level controller shall utilize a removable, hermetically sealed stainless steel immersion type 3 probe (1 ground) system with a probe holder and control panel.

E. The new vertical probe chamber shall be an appendage to the existing balance tank.

F. The probe chamber shall be constructed of clear PCV as shown on the drawings.

G. The auto-level sensing system shall additionally include a 1" normally closed solenoid valve and 1" control and manual by-pass valves.

H. Water Level Control System Shall Consist Of The Following Components:

1. Control box: Warrick # 16ML1A4-X-06-06 (One Required)
2. Probe Holder: Warrick # 3G3B1 (One Required)
3. Probes: Warrick # 3R3C0 (Three Required)
4. Solenoid Valve: Asco # 8221G7 (One Required)

I. The Pool Contractor shall connect to a reduced pressure zone (RPZ) backflow preventer valve in the filter area for the make-up water feed. The RPZ valve is not included in the work of this section.

2.10 AUTOMATIC POOL CLEANER

A. The Contractor shall supply and install an automated, robotic pool cleaner (ARPC).

B. The ARPC will include a 100 GPM on-board pressure pump designed to provide unit propulsion and high-pressure surface agitation of pool floor area being cleaned.

C. The ARPC pump shall include a thermostat box to regulate temperature, prolong motor life and reduce service costs.

D. The ARPC pump shall include an external digital 1-9 hour adjustable automatic shut-off timer.

E. The ARPC shall be substantially free of consumable “wear and tear” parts.

F. The ARPC shall include 120’ floating cable.

G. The ARPC shall have a maximum weight of 20 lbs.

H. The ARPC shall include both fine and standard filters with one extra for owner’s future use.

I. The ARPC shall include obstacle sensors to detect walls and objects in the pool.

J. The ARPC shall include magnetic sensors detect stopped motion.

K. The ARPC shall include non-scuff rubber wheels. Units requiring belts or tracks shall not be deemed as meeting the design intent.

L. The ARPC shall have a two-year warranty on plastics, electronics and motors.

M. The basis for design is the Jetmax Turbo by Aqua Products. (www.aquaproducts.com, 888-278-2832).

N. The contractor shall include the optional pole attachment for manual use.

O. The contractor shall provide three, stainless steel, 1¼” X 8’ threaded poles and any other incidental adaptors or components necessary to accommodate manual use. Poles to be Recreonics catalogue number 10-330 or equal (www.recreonics.com, 800-428-3254).
PART 3 - EXECUTION

3.1 SELECTIVE DEMOLITION

A. Before any demolition of the pool shall commence, the Contractor shall place batter boards or other appropriate device locating the existing finished elevation of the main drains for reference as the project advances.

B. Coordinate with other trades and the owner’s representative to determine if any minor change in the elevation is required in conjunction with the new finishes.

C. Demolish and remove existing main drains and demolish for new bottom drains as shown on the drawings. Remove spoils from site. Take care to preserve existing PVC pipe for connection of new drains. (Note: Precise as-built documents are unavailable. Contractor shall anticipate unpredictable and difficult field conditions for this item of work. It is anticipated that all of the demolition will be in concrete as the pools include concrete ballast integral with the pool structures. A change order for concealed conditions will not be given favorable consideration)

3.2 PIPE INSTALLATION

A. Handling - pipe and accessories shall be handled in such a manner as to insure delivery to the trench in sound, undamaged condition.

B. Cutting of pipe - shall be done in a neat and workmanlike manner without damage to the pipe.

C. Placing and Laying - before installation, pipe shall be inspected for defects. The interior of the pipe shall be thoroughly cleaned of foreign matter and shall be kept clean during laying operation. Pipe shall not be laid in weather conditions unsuitable for the work. Open ends of pipe and fittings shall be securely closed so that no trench water, earth of other substances will enter the pipes of fittings.

3.3 PIPE JOINTS

A. Mechanical, Threaded, and Solvent-Welded Joints - shall be made in accordance with the manufacturer’s recommendations.

B. All connections between PVC and metal pipes must be flanged, plastic flange to metal flange, except where specifically noted otherwise.

3.4 PIPE FLUSHING

A. All pipelines leading to the pool shall be thoroughly flushed clean before the pool is filled and placed in use.

END OF SECTION 13150
SECTION 13151 – MEDIUM PRESSURE ULTRA VIOLET LIGHT SYSTEM

PART 1 - GENERAL

1.1 ULTRA VIOLET DISINFECTION SYSTEM

A. This section covers equipment, materials, accessories, and supplier’s services required to provide a closed vessel, pressurized flow, medium-pressure ultraviolet (UV) lamp disinfection system with a UV intensity monitoring system. The UV system shall be complete and operational with all control equipment and accessories as shown and specified herein.

B. The UV disinfection system shall have been certified according to the NSF Standard 50 including Annex H certification. Non-certified systems shall not be acceptable.

C. The UV disinfection system shall be comprised of:

1. Reaction chamber, including: medium-pressure UV lamps, UV intensity sensor(s), a mechanical cleaning system, and cleaning ports.
2. Control panel, including: ballasts, power distribution components, and HPC-II controller with display unit.

1.2 SUBMITTALS

A. The following engineering drawings and documents shall be submitted for review and approval:

1. Complete description in sufficient detail to permit comparison with the specifications.
2. Dimensions and installation requirements.
3. Descriptive information, including catalog cut sheets and manufacturers’ literature for all major components.
4. Electrical schematics and layouts.
5. NSF standard 50 / Annex H Certification.

1.3 DESIGN CONDITIONS

A. The UV system shall be provided for the following design and operating conditions:

1. Design flow: 500 - 725 gpm
2. Water temperature: 820 – 840
3. Total Alkalinity: 100 – 125 ppm
4. Hardness (CaCO3): 150 – 250 ppm

B. Design UV Dose
1. The system shall be designed to deliver a Reduction Equivalent Dose (RED) of 600 J/m² based on the end of lamp lifetime (70% of specified new lamp output according to NSF).

C. System shall comprise one (1) duty reactor.

PART 2 - PRODUCTS

2.1 UV SYSTEM

A. Manufacturer qualifications.

1. The manufacturer shall be qualified and experienced in the supply of similar equipment. Manufacturer shall have at least 5 years of experience in supplying and delivering closed vessel UV systems with medium-pressure UV lamps used for water treatment applications.

2. The manufacturer shall have a minimum of 100 fully operating systems using technology identical in all aspects (i.e., medium-pressure UV lamps) to that being proposed.

B. Reaction Chamber

1. The UV reactor shall be a welded construction, manufactured from stainless steel 316Ti of a thickness of no less than 2mm The UV reactor shall be passivated.

2. The UV reactor shall be designed to handle a maximum operating pressure of 145 psig (10 Bar) and shall be fully assembled and then hydro tested to 1.5 times the design pressure in the factory prior to shipment.

3. The UV reactor shall be supplied with 8-inch 150# ANSI flanged inlet/outlet connections.

4. The UV reactor shall be provided with two (2) cleaning ports.

5. The UV reactor shall be designed such that the operating personnel can change the lamp(s) without draining the reactor.

C. UV Lamps

1. Lamps shall be medium-pressure mercury UV lamps. The medium-pressure mercury UV lamps must be provided with ceramic lamp ending for cooling and proper lamp positioning inside the quartz sleeve.

2. The system must incorporate a mechanical switch in which to disable power to the lamps should the chamber be opened while in use. Systems not incorporating such device will not be accepted. For safety purposes for operating personnel, if upon field inspection the referenced switch is not present one shall be installed and supplied at the contractor's
expense. If the system is not capable of accepting such a safety device the system shall be replaced at no additional cost to the owner.

3. Each lamp will be capable of producing a wavelength range of 200 - 400 nm, following a 100-hour burn-in period. Low-pressure, low-output and low-pressure, high-output UV lamps shall not be permitted due to the increase in quantity of lamps required.

4. The filament shall be significantly rugged to withstand shock and vibration.

5. The lamp bases shall be resistant to UV and ozone.

6. The UV lamps shall be guaranteed for 8,000 hours of operation, prorated after 1,000 hours.

7. The lamp output shall not fluctuate at all due to water temperature variations.

D. Quartz Sleeves

1. Each UV lamp assembly shall consist of a UV lamp enclosed in an individual quartz sleeve, with both ends appropriately sealed using an O-ring with sealing screw.

2. The UV lamp sleeve shall be a single piece of cleat used quartz circular tubing open at both ends.

3. The quartz sleeve shall be rated for an initial minimum UV transmittance (254 nm, 1 mm) of 86%.

4. The electrical connections to the lamp assembly shall be made at both sides of the lamps with a single wire connection in an easy to operate plug-in terminal.

5. The lamp assembly shall allow all of the following to be easily achieved by an operator for maintenance purposes: (a) Access to the lamp connections without removing or disconnecting any cables and without the use of special tools. (b) Disconnection of lamp power cable only, without removing the UV lamp or the lamp assembly from the reactor. (c) Easy lamp positioning due combined cooling and centering ceramics on the lamp. (d) A lamp assembly also needs to include two soft metal springs for positioning the lamp automatically in the center of the treatment chamber.

E. UV Intensity Sensor

1. The UV intensity sensor shall be selective only to the electromagnetic spectrum specific to UV light (200-400 nm). UV light outside the 200-400 nm range shall not be measured. The sensor shall be designed with an accuracy of ± 5%. The sensor must have a measuring angle of 40° at a wavelength of 400 nm.
2. The measured intensity shall be displayed on the operator interface (HPC-II) as an absolute value in W/m².
3. The UV intensity sensor connection must be realized with a two (2) wire 4 - 20 mA connection with watertight connector on top of the sensor housing.
4. The UV sensor must be absolute calibrated by the producer. UV sensors or sensor signal display modules that require recalibration after installation (a) new UV lamp(s) (after 100 burn in hours) are not acceptable. UV sensors of which the output signal or display systems on which the UV intensity can be "calibrated" are not acceptable. The UV intensity display must be able to provide a read-out in absolute units being "W/m²" and "%".

F. Control Panel

1. The control panel shall house all power distribution and control hardware.
2. The control panel shall be designed to operate with power feed of 480V, single-phase, 60 Hz.
3. The control panel enclosure shall be painted sheet steel NEMA 12 rated for indoor installation.
4. The control panel enclosure shall be located in an ambient temperature-controlled environment where the maximum temperature does not exceed 104° F (40° C). The control panel must be cooled by an independent forced-ventilation system and the air in- and outlet openings must be protected by dust filters. The temperature inside the control panel must be monitored by a built-in temperature sensitive device.
5. The cable length distance between the control panel and the UV reaction chamber shall be 16 ft.
6. The control panel must include a GFI device with a sensitivity of 30 mA for personal and system protection.
7. Local over-current protection shall be provided by the contractor.

G. Ballasts

1. Each lamp shall be operated by two (2) conventional electromagnetic ballasts or one (1) conventional electromagnetic ballast and a transformer; for systems with lamps operated by two ballasts, one ballast shall be for the ground power and the other for the lamp power control functionality; with a ballast - transformer combination the ballast is used for the power control functionality.
2. The ballast cooling system shall include an independent forced-ventilation system in the control panel to reduce the risk of ballast over-heating.
Control panels that rely on natural ventilation based ballast cooling system shall not be acceptable.

3. Multitap ballast technology shall be utilized to provide four (4) levels of power to the lamps. The power shall automatically increase or decrease to maintain operating intensity while maximizing lamp life and minimizing power consumption.

H. Control and Instrumentation

1. Lamp Power Control and UV Intensity Pacing shall be included as standard.
   a. The UV intensity shall be continuously monitored. As the intensity varies with lamp age, water quality or fouling of the quartz sleeve, the lamp power shall be automatically adjusted to maintain sufficient, microbiological safe operation in the most economical way. All control hardware and software shall be contained within the control panel.
   b. The unit shall be furnished with two temperature high limit switches. One shall monitor water temperature inside the reactor with visual alarm on high limit temperature. The second shall monitor the reactor chamber wall temperature and shall shut off the unit should temperature exceed high limit settings by manufacture.
   c. The UV system shall be monitored and controlled by Siemens Water Technologies - Wallace & Tiernan Products HPC-II circuit board controller.

2. Operator Interface
   a. The operator interface shall be Siemens Water Technologies - Wallace & Tiernan Products HPC-II display unit.
   b. The HPC-II unit shall be menu driven and shall display the following system information when prompted:

   UV lamp operating hours per power level and per lamp (if more than one (1) lamp is used)
   UV intensity in W/m² or %
   Flow in USGPM or m³/h (measured by an external flow meter specified elsewhere)
   UV lamp ON/OFF switching
   Water temperature in °F or °C
   Disinfection level of the UV lamps
   Cleaning interval of automatic cleaning mechanism
   Counter for the automatic cleaning mechanism actions
   LED indicator test
   Output status of the potential free relay output contacts
   Reset alarms
   Software version

3. The HPC-II unit shall be able to:
a. Manually activate the automatic cleaning mechanism
b. Activate sample mode for UV sensor check

I. Cleaning System

1. Each UV system must have an automatically operated mechanical cleaning system for the quartz sleeve(s).

2. The automatically operated cleaning mechanism must have one (1) special UV resistant Viton rubber cleaning ring mounted in a Teflon cleaning ring holder per quartz sleeve. The cleaning ring holder must be mounted in a stainless steel plate which is connected to the rod or axis that operates the cleaning action. Only one (1) cleaning ring per quartz sleeve may be used; systems with more cleaning rings per quartz sleeve will have a disturbed hydraulic pattern inside the radiation chamber, and shall not be acceptable.

3. The automatic cleaning system shall monitor wiper position by measuring revolutions of the wiper shaft position. Systems utilizing limit switches shall not be acceptable.

4. The automatic cleaning system shall be a direct drive wiper assembly. Systems using a belt drive system shall not be considered.

5. Each UV reaction chamber shall be provided with the necessary connections to connect a chemical cleaning system. Systems that do not include chemical cleaning connections on the treatment chamber shall not be acceptable.

6. During the duration of a cleaning action no UV alarm or warning signal be activated if the cleaning mechanism passed the UV sensor position.

2.2 MANUFACTURERS

A. The basis for design is the Siemens/Wallace & Tiernan, model Barrier M525. Comparable products manufactured by Hanovia and ETS shall be considered equivalent. Whether named or not, equivalent products must have compatible power requirements and must satisfy the design intent expressed by the project drawings or specifications. The contractor shall assume all design responsibilities or costs associated with the use of products other than the basis for design.

B. All Siemens components specified in this section are available as noted below;

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Regional Sales Manager- Eastern N/A Aquatics Division
Siemens Water Technologies Corp.
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Baraboo, WI 53913-0036
robert.kappel@siemens.com
Main Office: 608.356.1059
Facsimile: 608.356.1023
Bradley Office: 866.766.5987
www.siemens.com/water
2.3 WARRANTY

A. The UV disinfection system will conform to the description set forth in this proposal and, with the exception of consumables such as UV lamps, shall be warranted to be free of defects in materials and workmanship, including damages that may be incurred during shipping, for a period of one (1) year from start-up or 18 months after final shipment, whichever occurs first. The severity of the defect will determine the requirement of a site visit. All travel expenses, accommodations, etc., for a service visit due to a defect deemed severe by the Supplier shall be included in the warranty. Travel expenses for procedures classified as routine maintenance (i.e., lamp, sleeve, ballast and sensor replacement) are not included under this warranty.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of the equipment shall be in accordance with the contract drawings, manufacturer’s engineering drawings, and instructions.

3.2 SUPPLIER’S SERVICES

A. The start-up technician shall certify to the owner that all equipment is properly installed, and that the plant operators have been instructed on proper operation and maintenance procedures.

B. Field services by the UV manufacturer or its authorized representative shall consist of Installation supervision, Start-up, field testing and operator training.

END OF SECTION 13151
SECTION 13152 - OPTIONAL AUTOMATIC CHEMISTRY CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The pool Contractor shall supply and install an integrated microprocessor-based
electronic water treatment control system shall be furnished.

1. The unit shall continuously monitor and control pH, High Resolution
Redox (HRR), part per million of chlorine/bromine, water temperature.
2. The recirculation system flow rate, relay mode, time, date, and sample
flow status shall also be displayed.
3. The controller shall incorporate plug-in printed circuit boards (PCB) and
shall feature a data modem or an Ethernet communication device.
Professional version of DAQFactory® Microsoft Windows TM based
software for interactive connection between the controller and an IBM
compatible computer shall be part of the system.

PART 2 - PRODUCTS

2.1 DESCRIPTION OF WORK

A. Controller

1. Housing and Mounting
   a. The control system and touch screen display shall be housed in
      independent nonmetallic NEMA 4X rated enclosures. The
      enclosures and connections shall be designed to eliminate any
      possibility of corrosion or damage to the internal components of
      the controller. Controller and external relays shall be factory wired
      and tested for functionality.

2. Display
   a. Controller shall have a 6" alphanumeric, touch screen display with
      constant backlighting.
   b. Continuous, real-time display of pH, HRR, temperature, chlorine
      level in ppm and filter operating pressure/vacuum and the system
      flow rate.
   c. Date, time and alarm status
   d. Pool water level adjustment
   e. Descriptive alarm messages - Alarm Display shall be a flashing
      touch screen graphic and shall be provided with visual pH and
      chlorine/bromine feed pump graphics which are activated as
      chemicals are being fed. Controller shall also display paused
      mode of proportional chemical feed. Visual alarm indicators to
warn operator of high or low pH, HRR, temperature, chlorine levels, low or no flow and fail-safe conditions.
f. Overlay shall be treated to resist influence of ultraviolet ray degradation.

3. Monitoring and Operating Displays

a. pH level shall be continuously monitored and displayed digitally on the touch screen, within a range of 2-12 with a 0.1 pH resolution. Touch screen pH set points shall be programmable to limit operator selection of pH set points to comply with health code limitation.
b. HRR level shall be continuously monitored and digitally displayed in millivolts (mv) on the touch screen, within a range of 0-1000 mv with a 1 mv resolution. Touch screen HRR set points shall be programmable to limit operator selection of HRR set points to comply with health code limitation.
c. Chlorine/bromine residual shall be continuously monitored and displayed digitally on the touch screen. The ppm display range shall be 0-20 ppm with a 0.1 resolution. Touch screen chlorine/bromine set points shall be programmable to limit operator selection of set points to comply with health code limitations.
d. Temperature of the swimming pool water shall be capable of being continuously monitored, controlled and digitally displayed on the unit touch screen.
e. Flow rate shall be continuously monitored and displayed digitally on the touch screen.

4. Output Circuits

a. Four (4) controller output circuits shall be provided and capable of handling standard line voltage at 5 amps each for pH and chlorine/bromine feed control, for the time clock controlled functions, and for a master alarm signal. Fuses shall be used to protect solid state relay controlled outputs.
b. Automatic outputs shall be capable of being manually overridden with touch screen interface for pH and HRR, and chlorine/bromine shall be provided to allow for direct and complete manual override. The closing of any of these momentary contacts will switch incoming line voltage directly to the feeder output circuit.

5. Chemical Feed Programming

a. The control system shall be capable of being programmed for either standard on/off feed control or a time based proportional feed control mode. Time based proportional feed logic shall automatically adjust, within a settable time base of 10-600 seconds, the operating time of the feed unit, cycling on and off if unit falls below set point. Cycling time will be variable based upon continuance of set point variation.
b. The unit shall also provide for a "proportional band" of 0-99 mV (0-1.5 pH units) with each mY offset from set point causing the feeder to be on for one second. Minimum feeder "on time" shall be no less than five seconds to ensure proper pump performance. The controller shall govern the output of any chemical feeder from 10% to 100% of maximum rated capacity.

c. The system shall operate in such a manner as to make unnecessary, under ordinary or extraordinary conditions, any manual increase or decrease of feeder output settings by operating personnel in order to maintain set point. Units allowing only on/off control of chemical feeders or requiring use of special proportional-band feed devices (4-20 mA or 0-100 strokes per minute inputs) to achieve proportional control shall not be considered equal.

6. Feed Duration - The system shall be equipped with an internal microprocessor-based feed duration alarm circuit that shall disable the appropriate chemical feeder(s) and energize an alarm circuit in the event of:

a. Electrode (sensor) failures
b. Chemical feeder malfunctions
c. Depletion of chemical supply source
d. The time base of the feed duration alarm circuit shall be programmable from 0 through 24 hours with one (1) minute resolution. In addition, an internal software switch shall make it possible to disable the feed duration alarm circuit entirely without affecting other system operations. Units incorporating mechanical-type overfeed timers shall not be considered equal.

7. Indicators. Alarms and Warnings

a. The control system shall be provided with pH and HRR feed indicators, which shall be activated when respective chemicals are being fed.

b. System shall be provided with visual high and low pH and HRR alarms. High pH alarm shall prevent soda ash and hypochlorite feed and low pH alarm shall prevent acid feed and gas chlorine feed. High HRR alarm shall disable HRR oxidant feed.

c. System shall be capable of accepting a low voltage on/off flow indication signal via hard wire connection on internal circuitry. The system shall provide a low flow warning message to alert operator when no flow situation exists in the sample stream. Should a no flow condition exist, the system shall disable all chemical feed functions.

d. The control system shall be provided with an internal microprocessor based "feed duration alarm" circuit that shall disable the appropriate chemical feeder(s) and energize an alarm circuit in the event of: a) sensor failures, b) chemical feeder malfunctions, and c) depletion of chemical supply.
e. The fail/safe alarm mode shall be programmable from 0 through 18 hours with 1 minute resolution. In addition, an internal software switch shall make it possible to disable the feed duration alarm circuit entirely without affecting other controller operations. Units incorporating mechanical-type overfeed timers shall not be considered equal.

f. An alarm condition shall activate a remote master alarm signal, provided as a dry contact closure, enabling the use of 0-280 VAC alarms.

8. Electronic Timer

a. A microprocessor circuit shall provide control over a sensor rinse function or any other chemical feed function activated on a time basis. The timer shall energize a solid-state relay.

9. Data Logging and Security

a. Controller shall be capable of logging up to sixty eight (60) days of data relating to pH and HRR readings; any alarm conditions; any set point adjustments; and feed event history. Frequency of logged input points shall be selectable from 1 — 60 minutes. Controller shall be capable of downloading logged data onto an IBM compatible computer using Ethernet, modem or direct cable and software, which shall be provided with the controller.

b. The logic of the system shall include a three level security code system, allowing access to pH, HRR, ppm, temperature and alarm set points. Security system will allow separate manager [(2) codes], operator [ (6) codes] and a factory authorized system entry. Security system shall also provide history of access identified by user.

10. Monitoring Feature

a. The controller shall be equipped with a plug-in printed circuit board (PCB) with a 33,600 baud rate modem providing remote interface with any IBM compatible computer and remote system communication with any touch tone telephone. The PCB and modem shall be an integral part of the chemical control feed control system and shall enable service and operating personnel to perform the following functions:

1) Remotely access current pool water conditions and controller status.
2) Remotely download historical data relating to water chemistry readings, alarm status,
3) feed event history, and set point adjustments.
4) Remotely adjust feed set points, feed modes, and alarm set points.
b. The controller shall be equipped with an Ethernet connection device for connection to the owner's LAN.

11. UV Interface

a. When available from the manufacturer, a software algorithm shall be included so as to enable the chemistry controller to sense increased bather activity based on HRR and PPM values and to automatically adjust the UV lamp intensity accordingly.

12. Windows Based Software

a. Software shall be Windows based interactive designed specifically for monitoring and controlling pool water chemistry. The Software shall be compatible with all versions of Microsoft Windows™. DOS based software will not be accepted.

b. Software shall have a Graphical User Interface and Water Database Management Package.

c. Software will allow for direct and/or remote access and manipulation of all functions related to the controller. Long-term operational data shall also be retrievable on-site or from a remote location.

d. All software parameters shall be programmable and accessible through an organized step level-programming tree with pop-up windows prompting for a value.

e. Software shall enable user to change setting by clicking on the desired option.

B. Flowcell and Sensor Assembly

1. The control system shall include a sensing chamber, a flow switch, and sensor assemblies, all of which shall incorporate the following features:

a. An integral self-air purging sensing chamber designed to accommodate four sensing devises shall be provided. The chamber body shall be PVC with a clear polycarbonate inspection cover. All plumbing, PVC Schedule 80, consisting of shut off valves, backflow device, nipples, elbows, sampling cocks, compound gauge and flow switch shall be supplied. The flow switch shall be of the paddle wheel-style with see-through cover and "on stream" light. Flow switch shall indicate flow (at least .9 gpm) through the sample stream and signal the controller to initiate an alarm condition and to shut off feed circuits in the event flow should stop. Flow switch shall operate on low voltage and be made of non-corrosive material. Flow cell and plumbing shall be mounted to a back panel housed with a gasketed enclosure.

b. pH and HRR sensor shall contain no less than 28 milliliters of electrolyte gel to assure reasonable electrode life. The gel used in each electrode shall be inorganic so as to prevent degradation by chlorine or bromine. The Redox sensor shall be of the patented
HRR technology. HRR sensing electrode shall incorporate at least 1 square centimeter of 99.99% pure platinum and operate in temperatures between 32 - 150° F (0—66° C). Each electrode shall use a porous Teflon liquid junction to minimize the chance of liquid junction clogging and prolong electrode life. pH and HRR sensors shall incorporate shielded BNC connectors to insure continuity of connection. To insure accuracy and compatibility, the controller manufacturer shall manufacture the sensing probes. Electrodes not utilizing the above technology or organic gels or wood or ceramic liquid junctions or connectors other than shielded BNC will not be considered equal to these specifications.

c. Temperature sensor shall be of the RTD type having a two (2) wire cable of the low noise type with appropriate connectors. Cable and connectors shall meet or exceed Military Specifications. To insure accuracy and compatibility, the controller manufacturer shall manufacture the sensing probes.

d. Free ppm sensor shall be a membrane sensing with electrolyte liquid junction type. The connection shall be a three (3)-wire cable of the low noise with appropriate connectors.

e. Flow Sensor is a self-powered paddlewheel flow sensor with saddle fitting shall be provided. Cast mounting saddles shall be provided with U-Bolts for mounting.

C. SENSOR WASH SYSTEM

1. An automatic sensor wash system shall be provided. The system shall consist of one 6-gallon vapor-proof tank, one feed pump capable of pumping up to 10 gallons per day at 75 psi, and a four-function antisyphon/pressure relief valve. Digital programmable electronic timer in the chemical controller shall control the pump.

D. START-UP AND WARRANTY

1. The system shall be provided with an illustrated installation, operating and maintenance manual. Drawings and detailed written description of features and operating phases of the control system shall be a part of the operating and maintenance manual.

2. The control system shall be provided with on-site start-up, on-site operator training, and one (1) year of on-site warranty service, all of which shall be performed by a representative trained and authorized by the controller’s manufacturer.

3. The system shall carry a twenty-four (24) month limited warranty against defects in material and workmanship for all components including electronics, flow cell assembly and probes.

E. MANUFACTURERS

1. The basis for chemical controller design is the IMPACT by Siemens/Stranco Products, Bradley, Illinois. Comparable products
manufactured by Acutrol and Chemtrol shall be considered equivalent. Whether named or not, equivalent products must satisfy the design intent expressed by the project drawings or specifications. The contractor shall assume all design responsibilities or costs associated with the use of products other than the basis for design.

2. All Siemens components specified in this section are available as noted below;
   Robert C. Kappel
   Regional Sales Manager- Eastern N/A Aquatics Division
   Siemens Water Technologies Corp.
   PO Box 36
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   robert.kappel@siemens.com
   Main Office: 608.356.1059
   Facsimile: 608.356.1023
   Bradley Office: 866.766.5987
   www.siemens.com/water

PART 3 - EXECUTION

3.1 DESCRIPTION OF WORK

A. INSTALLATION

1. The existing chemistry controller will continue to serve as the filtration system automation.

2. Contractor shall provide any incidental parts, components or work necessary to reconnect the new controller to the existing chemical feed equipment.

END OF SECTION 13152
SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

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 basic mechanical materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Escutcheons.
3. Dielectric fittings.
4. Flexible connectors.
5. Mechanical sleeve seals.
6. Equipment nameplate data requirements.
7. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
8. Non-shrink grout for equipment installations.
10. Installation requirements common to equipment specification sections.
11. Mechanical demolition.
12. Cutting and patching.

B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, 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 in duct shafts.
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. PE: Polyethylene plastic.
   2. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:
   1. CR: Chlorosulfonated polyethylene synthetic rubber.
   2. EPDM: Ethylene propylene diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For dielectric fittings, flexible connectors, mechanical sleeve seals, and identification materials and devices.

B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

1.5 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning 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 prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

D. Store ductwork and accessories indoors only. Cover to protect from dirt intrusion.

1.7 SEQUENCING AND SCHEDULING
A. Coordinate mechanical equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2.2 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe 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 15 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 32.

1. Alloy Sn95 or Alloy Sn94: Approximately 95 percent tin and 5 percent silver, with 0.10 percent lead content.

2. Alloy E: Approximately 95 percent tin and 5 percent copper, with 0.10 percent maximum lead content.

3. Alloy HA: Tin-antimony-silver-copper zinc, with 0.10 percent maximum lead content.

4. Alloy HB: Tin-antimony-silver-copper nickel, with 0.10 percent maximum lead content.
5. Alloy Sb5: 95 percent tin and 5 percent antimony, with 0.20 percent maximum lead content.

C. Couplings: Iron-body sleeve assembly, fabricated to match OD of plain-end, pressure pipes.

2. Followers: ASTM A 47M malleable iron or ASTM A 536 ductile iron.
5. Finish: Enamel paint.

2.4 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.
   a. Finish: Rough brass.
   b. Finish: Polished chrome-plate.

   a. Finish: Rough brass.
   b. Finish: Polished chrome-plate.

2.5 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer’s standard products of categories and types required for each application as referenced in other Division 15 Sections. If more than one type is specified for application, selection is Installer’s option, but provides one selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes complying with recommendations of ASME A13.1 for piping and similar applications, but not less than 1¾" (30-mm) high letters for ductwork and not less than ¾"(19-mm) high letters for access door signs and similar operational instructions.

3. Stencil Paint: Standard exterior-type stenciling enamel; black, unless otherwise indicated; either brushing grade or pressurized spray-can form and grade.
4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

2.6 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: 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 at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast brass, one piece, with set screw, and polished chrome-plated finish. Use split-casting escutcheons if required, for existing piping.
2. Uninsulated Piping Wall Escutcheons: Cast brass or stamped steel, with set screw.
3. Insulated Piping: Cast brass with concealed hinge, spring clips, and chrome-plated finish.
4. Piping in Utility Areas: Cast brass with set-screw or spring clips.

N. Verify final equipment locations for roughing-in.

O. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

P. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
4. 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:
   a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
   c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. 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.

5. Piping Connections: Make connections according to the following, unless otherwise indicated:

a. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Owner's Representative.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

E. Install equipment giving right of way to piping installed at required slope.

F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

2. Plastic markers, with application systems. Install on insulation segment if required for hot, uninsulated piping.
3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:

   a. Near each valve and control device
   b. Near each branch, excluding short takeoffs for fixtures and terminal units. Mark each pipe at branch, if flow pattern is not obvious.
c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.
d. At access doors, manholes, and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.
f. Spaced at maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
g. On piping above removable acoustical ceilings, except omit immediately spaced markers.

B. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.4 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed ductwork and piping according to the following, unless otherwise indicated:

1. Interior, Ferrous: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.
5. Exterior, Galvanized-Steel: Use semigloss, acrylic-enamel finish. Include two finish coats over galvanized metal primer.

C. Do not paint duct and piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Attach to substrates as required to support applied loads.

3.6 DEMOLITION
A. Disconnect, demolish, and remove Work specified in Division 15 Sections.

B. If pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.

C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

D. Work Abandoned in Place: Cut and remove underground pipe a minimum of 2 inches (50 mm) beyond face of adjacent construction. Cap and patch surface to match existing finish.

E. Removal: Remove indicated equipment from Project site.

F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.7 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.8 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer’s written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer’s written instructions.

END OF SECTION 15050
SECTION 15055 - MOTORS

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 basic requirements for factory-installed and field-installed motors.

B. Related sections include the following:

1. Division 15 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.3 SUBMITTALS

A. Product Data: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Listing and Labeling: Provide motors specified in this Section that are listed and labeled.

1. Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.


PART 2 - PRODUCTS

2.1 BASIC MOTOR REQUIREMENTS

A. Basic requirements apply to mechanical equipment motors, unless otherwise indicated.

B. Motors 3/4 HP and Larger: Polyphase.
C. Motors smaller than 3/4 HP: Single phase.

D. Frequency Rating: 60 Hz.

E. Voltage Rating: Determined by voltage of circuit to which motor is connected.

F. Service Factor: According to NEMA MG 1, unless otherwise indicated.

G. Capacity and Torque Characteristics: Rated for continuous duty and sufficient to start, accelerate, and operate connected loads at designated speeds, in indicated environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

H. Enclosure: Open dripproof, unless otherwise indicated.

2.2 POLYPHASE MOTORS

A. Description: NEMA MG 1, medium induction motor.

1. Design Characteristics: NEMA MG 1, Design B, unless otherwise indicated.
3. Stator: Copper windings, unless otherwise indicated. Multi-speed motors have separate winding for each speed.
4. Rotor: Squirrel cage, unless otherwise indicated.
5. Bearings: Double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading.
6. Temperature Rise: Match insulation rating, unless otherwise indicated.
7. Insulation: Class F, unless otherwise indicated.

B. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for indicated controller, with required motor leads brought to motor terminal box to suit control method.

C. Rugged-Duty Motors: Where indicated, motors are totally enclosed with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings are insulated with non-hygroscopic material. External finish is chemical-resistant paint over corrosion-resistant primer.

D. Source Quality Control: Perform the following routine tests according to NEMA MG 1:

1. Measurement of winding resistance.
2. No-load readings of current and speed at rated voltage and frequency.
3. Locked rotor current at rated frequency.
4. High-potential test.
5. Alignment.

E. Motors with 10HP or greater:

1. Motors shall have a power factor of 0.9 or greater. If not capacitors shall be provided.
2. Motors shall have phase los, phase imbalance, under and over voltage protection provided. ICM 450 or equal.

2.3 SINGLE-PHASE MOTORS

A. Type: As indicated or selected by manufacturer from one of the following, to suit starting torque and other requirements of specific motor application.

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: Do not use, unless motors are smaller than 1/20 hp.

C. Thermal Protection: Where indicated or required, internal protection automatically opens power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device automatically resets when motor temperature returns to normal range, unless otherwise indicated.

D. Bearings: Ball-bearing type for belt-connected motors and other motors with high radial forces on motor shaft. Sealed, pre-lubricated sleeve bearings for other single-phase motors.

PART 3 - EXECUTION

3.1 ADJUSTING

A. Use adjustable motor mounting bases for belt-driven motors.

B. Align pulleys and install belts.

C. Tension according to manufacturer's written instructions.

END OF SECTION 15055
SECTION 15060 - HANGERS AND SUPPORTS

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 hangers and supports for mechanical system piping and equipment.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

C. Design seismic restraint hangers and supports for piping and equipment.

D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Indicate size and characteristics of components and fabrication details.

1.6 QUALITY ASSURANCE
A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Engineering Responsibility: For piping supports associated with the Fire Suppression piping system, the design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint shall be developed by a qualified professional engineer. Refer to drawings for requirements of roof loading support calculations to be performed by the Contractor.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:
   a. AAA Technology and Specialties Co., Inc.
   b. B-Line Systems, Inc.
   c. Carpenter & Patterson, Inc.
   d. Empire Tool & Manufacturing Co., Inc.
   e. Globe Pipe Hanger Products, Inc.
   f. Grinnell Corp.
   g. GS Metals Corp.
   h. Michigan Hanger Co., Inc.
   i. National Pipe Hanger Corp.
   j. PHD Manufacturing, Inc.
   k. PHS Industries, Inc.
   l. Piping Technology & Products, Inc.

2. Channel Support Systems:
   a. B-Line Systems, Inc.
   b. Grinnell Corp.; Power-Strut Unit.

3. GS Metals Corp.
   b. National Pipe Hanger Corp.
   c. Thomas & Betts Corp.
   d. Unistrut Corp.
4. Thermal-Hanger Shield Inserts:
   a. Carpenter & Patterson, Inc.
   b. Michigan Hanger Co., Inc.
   c. PHS Industries, Inc.
   d. Pipe Shields, Inc.
   e. Rilco Manufacturing Co., Inc.
   f. Value Engineered Products, Inc.

5. Powder-Actuated Fastener Systems:
   a. Gunnebo Fastening Corp.
   b. Hilti, Inc.
   c. ITW Ramset/Red Head.
   d. Masterset Fastening Systems, Inc.

2.2 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
   1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
   2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
   1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
   2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690 kPa) minimum compressive-strength insulation, encased in sheet metal shield.
   1. Material for Cold Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate with vapor barrier.
   2. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
   4. Material for Hot Piping: ASTM C 552, Type I cellular glass or water-repellent-treated, ASTM C 533, Type I calcium silicate.
   5. Material for Hot Piping: ASTM C 552, Type I cellular glass.
7. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
8. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
9. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.3 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, non-shrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Non-staining, non-corrosive, and non-gaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar joist construction to attach to top flange of structural shape.
2. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
3. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support 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. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.
C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

E. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. 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.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," are not exceeded.

K. 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 B31.9.
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 (DN100) 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 arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) 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 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) 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 above or to support equipment above floor.
   B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.4 METAL FABRICATION
   A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
   B. Fit exposed connections together to form hairline joints. Field-weld connections that cannot be shop-welded because of shipping size limitations.
   C. Field Welding: Comply with AWS D1.1 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 Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060
SECTION 15075 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Pipe markers.
3. Stencils.
4. Valve tags.
5. Valve schedules.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE


1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.
PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.
   c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.


E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils (0.08 mm) thick with pressure-sensitive, permanent-type, self-adhesive back.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): 3/4 inch (19 mm) minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches (150 mm) or Larger: 1-1/2 inches (38 mm) minimum.
2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches (32 mm) for ducts; and minimum letter height of 3/4 inch (19 mm) for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.

1. Stencil Material: Metal or fiberboard.
2. Stencil Paint: Exterior, gloss, acrylic enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1, unless otherwise indicated.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme approved by Engineer. Provide 5/32-inch (4-mm) hole for fastener.

1. Material: 0.032-inch- (0.8-mm-) thick brass.
2. Material: 0.0375-inch- (1-mm-) thick stainless steel.
3. Material: 3/32-inch- (2.4-mm-) thick laminated plastic with 2 black surfaces and white inner layer.
4. Valve-Tag Fasteners: Brass [wire-link or beaded chain; or S-hook.

2.5 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.
3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Pumps, compressors, condensers, and similar motor-driven units.
2. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
3. Fans, blowers, primary balancing dampers, and mixing boxes.
4. Packaged HVAC units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Fire department hose valves and hose stations.
   c. Meters, gages, thermometers, and similar units.
   d. Pumps, compressors, condensers, and similar motor-driven units.
   e. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
   f. Fans, blowers, primary balancing dampers, and mixing boxes.
   g. Packaged HVAC units.
   h. Tanks and pressure vessels.
   i. Strainers, filters, water-treatment systems, and similar equipment.

C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.
D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:
   a. Green: For cooling equipment and components.
   b. Yellow: For heating equipment and components.

2. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.

4. Include signs for the following general categories of equipment:
   a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   b. Pumps, compressors, condensers, and similar motor-driven units.
   c. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
   d. Fans, blowers, primary balancing dampers, and mixing boxes.
   e. Packaged HVAC units.
   f. Tanks and pressure vessels.
   g. Strainers, filters, water-treatment systems, and similar equipment.

E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch (25 mm) high is needed for proper identification because of distance from normal location of required identification.

F. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, 6 Inches and less (150 mm):
   Pretensioned pipe markers. Use size to ensure a tight fit.

2. Pipes with OD, Including Insulation, 6 Inches and less (150 mm):
   Self-adhesive pipe markers. Use color-coded, self-adhesive
plastic tape, 1-1/2 inches (38 mm) wide, lapped at least 1-1/2 inches (38 mm) at both ends of pipe marker, and covering full circumference of pipe.

B. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers complying with ASME A13.1 on each piping system.

1. Identification Paint: Use for contrasting background.

C. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.

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; plumbing fixture supply stops; 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:

1. Valve-Tag Size and Shape: 1-1/2 inches (38 mm) square.

3.5 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.
3.6 WARNING-TAG INSTALLATION
   A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 ADJUSTING
   A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.8 CLEANING
   A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 15075
SECTION 15080 - DUCT INSULATION

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 mechanical insulation for boiler breeching, duct, equipment, and pipe, including the following:

1. Insulation Materials:
   a. Cellular glass.
   b. Flexible elastomeric.
   c. Mineral fiber.

2. Fire-rated insulation systems.
3. Insulating cements.
4. Adhesives.
5. Mastics.
7. Sealants.
8. Factory-applied jackets.
10. Field-applied cloths.
11. Field-applied jackets.
12. Tapes.
13. Securements.

B. Related Sections include the following:

1. Division 15 Section "Metal Ducts."

1.3 DEFINITIONS

A. ASJ: All-service jacket.
B. FSK: Foil, scrim, kraft paper.
C. FSP: Foil, scrim, polyethylene.
D. PVDC: Polyvinylidene chloride.
E. SSL: Self-sealing lap.
1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:
   1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Insulation application at pipe expansion joints for each type of insulation.
   3. Application of field-applied jackets.
   4. Field application for each equipment type.

C. Installer Certificates: Signed by Contractor certifying that installers comply with requirements.

D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.5 QUALITY ASSURANCE

A. 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, 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

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.

1.8 SCHEDULING

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

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2. Products: Subject to compliance with requirements, provide one of the products specified.

3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about 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. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
1. Available Products:
   a. Cell-U-Foam Corporation; Ultra-CUF.
   b. Pittsburgh Corning Corporation; Foamglas Super K.

2. Block Insulation: ASTM C 552, Type I.
3. Special-Shaped Insulation: ASTM C 552, Type III.
4. Board Insulation: ASTM C 552, Type IV.
5. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. 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:
   a. Aeroflex USA Inc.; Aerocel.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

H. 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 Part 2 "Factory- Applied Jackets" Article.

1. Products:
   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.

2.3 INSULATING CEMENTS


1. Available Products:
   a. Insulco, Division of MFS, Inc.; Triple I.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Available Products:

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
   1. Products:
      a. Insulco, Division of MFS, Inc.; SmoothKote.
      c. Rock Wool Manufacturing Company; Delta One Shot.

2.4 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F (minus 59 to plus 149 deg C).
   1. Available Products:
      a. Childers Products, Division of ITW; CP-96.

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
   1. Products:
      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.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Products:
      a. Childers Products, Division of ITW; CP-82.
      c. Marathon Industries, Inc.; 225.
      d. Mon-Eco Industries, Inc.; 22-25.

   1. Products:
      a. Childers Products, Division of ITW; CP-82.
      c. Marathon Industries, Inc.; 225.
      d. Mon-Eco Industries, Inc.; 22-25.
F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:
   a. Dow Chemical Company (The); 739, Dow Silicone.
   e. Speedline Corporation; Speedline Vinyl Adhesive.

2.5 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:
   a. Childers Products, Division of ITW; CP-35.
   b. Foster Products Corporation, H. B. Fuller Company; 30-90.
   c. Marathon Industries, Inc.; 590.
   d. Mon-Eco Industries, Inc.; 55-40.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1. Products:
   a. Childers Products, Division of ITW; CP-30.
   b. Foster Products Corporation, H. B. Fuller Company; 30-35.
   d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 130 deg F (Minus 18 to plus 82 deg C).
D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

1. Products:
   a. Childers Products, Division of ITW; Encacel.
   b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
   c. Marathon Industries, Inc.; 570.
   d. Mon-Eco Industries, Inc.; 55-70.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.

3. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.


2.6 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Products:
   a. Childers Products, Division of ITW; CP-52.
   b. Foster Products Corporation, H. B. Fuller Company; 81-42.
   c. Marathon Industries, Inc.; 130.
   d. Mon-Eco Industries, Inc.; 11-30.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.

3. Service Temperature Range: Minus 50 to plus 180 deg F (Minus 46 to plus 82 deg C).


2.7 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products:
   a. Childers Products, Division of ITW; CP-76.
   b. Foster Products Corporation, H. B. Fuller Company; 30-45.
   c. Marathon Industries, Inc.; 405.
   d. Mon-Eco Industries, Inc.; 44-05.
   e. Pittsburgh Corning Corporation; Pittseal 444.

2. Joint Sealants for Polystyrene Products:
a. Childers Products, Division of ITW; CP-70.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.

3. Materials shall be compatible with insulation materials, jackets, and substrates.
4. Permanently flexible, elastomeric sealant.
5. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
6. Color: White or gray.

B. FSK and Metal Jacket Flashing Sealants:

1. Products:

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.

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 (Minus 40 to plus 121 deg C).
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Available Products:

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 (Minus 40 to plus 121 deg C).

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.

5. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

2.9 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. (203 g/sq. m) with a thread count of 5 strands by 5 strands/sq. inch (2 strands by 2 strands/sq. mm) for covering equipment.

1. Available Products:
   a. Childers Products, Division of ITW; Chil-Glas No. 5.

2.10 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. Metal Jacket:

1. Products:
   a. Childers Products, Division of ITW; Metal Jacketing Systems.
   b. PABCO Metals Corporation; Surefit.
   c. RPR Products, Inc.; Insul-Mate.
   e. Factory cut and rolled to size.
   f. Finish and thickness are indicated in field-applied jacket schedules.
   g. Moisture Barrier for Indoor Applications: 1-mil- (0.025-mm-) thick, heat-bonded polyethylene and kraft paper.
   h. Moisture Barrier for Outdoor Applications: 3-mil- (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.
   i. Factory-Fabricated Fitting Covers:
      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Beveled collars.
2.11 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Available Products:
   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 (75 mm).
3. Thickness: 11.5 mils (0.29 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) 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 and UL listed.

1. Available Products:
   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 (75 mm).
3. Thickness: 6.5 mils (0.16 mm).
4. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Available Products:
   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 (50 mm).
3. Thickness: 3.7 mils (0.093 mm).
4. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.12 SECUREMENTS

A. Bands:

1. Available Products:
   a. Childers Products; Bands.
   b. PABCO Metals Corporation; Bands.
   c. RPR Products, Inc.; Bands.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch (0.38 mm) thick, 3/4 inch (19 mm) wide with wing or closed seal.

3. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 3/4 inch (19 mm) wide with wing or closed seal.


B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

   a. Available Products:

      1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
      2) GEMCO; Perforated Base.
      3) Midwest Fasteners, Inc.; Spindle.

   b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

   c. Spindle: Aluminum, fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

   d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding
insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Available Products:
   1) GEMCO; Nylon Hangers.
   2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.

b. Baseplate: Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter.

c. Spindle: Nylon, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

3. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Available Products:
   1) AGM Industries, Inc.; Tactool Insul-Hangers, Series TSA.
   2) GEMCO; Press and Peel.
   3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. Spindle: Aluminum fully annealed, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

d. Adhesive-backed base with a peel-off protective cover.

4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Available Products:
   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.
5. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Available Manufacturers:
   1) GEMCO.
   2) Midwest Fasteners, Inc.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

D. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.
   1. Available Manufacturers:
      a. ACS Industries, Inc.
      b. C & F Wire.
      c. Childers Products.
      d. PABCO Metals Corporation.
      e. RPR Products, Inc.

2.13 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105 or 5005; Temper H-14.

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. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.
3.3 COMMON 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. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward
clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) 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.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

3.5 DUCT AND PLENUM INSULATION INSTALLATION

A. 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 50 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.

b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

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- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer’s recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.7 FINISHES

A. Duct, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.


B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer’s recommended protective coating.

C. Color: Final color as selected by Owner’s Representative. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.

B. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

3.10 DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, rectangular, round and air plenums, supply-air duct insulation shall be any of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

B. Concealed, rectangular, round and air plenums, return-air duct insulation shall be any of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber Blanket: 1-1/2 inches (38 mm (5) thick and 1.5-lb/cu. ft. (24-kg/cu. m)] nominal density.

C. Concealed, rectangular, round and air plenums, outdoor-air duct insulation shall be any of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

D. Concealed, rectangular, round and air plenums, exhaust-air duct insulation shall be any of the following:

1. Flexible Elastomeric: 1 inch (25 mm) thick.
2. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.

E. Exposed, rectangular, round and air plenums, supply-air duct insulation shall be the following:

1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m)] nominal density.

F. Exposed, rectangular, round and air plenums, return-air duct insulation shall be the following:

1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

G. Exposed, rectangular, round and air plenums, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

H. Exposed, rectangular, round and air plenums, exhaust-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

3.11 FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:
   1. None.

D. Ducts and Plenums, Exposed:
   1. Aluminum, Smooth: 0.020 inch (0.51 mm) thick.

END OF SECTION 15080
SECTION 15083 - PIPE INSULATION

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 preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:
   1. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.3 SUBMITTALS
A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:
   1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
   2. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   3. Removable insulation at piping specialties and equipment connections.
   4. Application of field-applied jackets.

C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.4 QUALITY ASSURANCE
A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label
insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification 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 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

1.7 SCHEDULING

A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Mineral-Fiber Insulation:
   a. CertainTeed Mason.
   b. Knauf FiberGlass GmbH.
   c. Owens-Corning Fiberglas Corp.
   d. Schuller International, Inc.

2. Cellular-Glass Insulation:
   a. Pittsburgh-Corning Corp.

2.2 INSULATION MATERIALS

A. Mineral-Fiber Insulation: Glass fibers bonded with a thermosetting resin complying with the following:
1. Preformed Pipe Insulation: Comply with ASTM C 547, Type 1, with factory-applied, all-purpose, vapor-retarder jacket.

2. Blanket Insulation: Comply with ASTM C 553, Type II, without facing.

3. Fire-Resistant Adhesive: Comply with MIL-A-3316C in the following classes and grades:
   a. Class 1, Grade A for bonding glass cloth and tape to unfaced glass-fiber insulation, for sealing edges of glass-fiber insulation, and for bonding lagging cloth to unfaced glass-fiber insulation.
   b. Class 2, Grade A for bonding glass-fiber insulation to metal surfaces.

4. Vapor-Retarder Mastics: Fire- and water-resistant, vapor-retarder mastic for indoor applications. Comply with MIL-C-19565C, Type II.


B. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.

1. Preformed Pipe Insulation, without Jacket: Comply with ASTM C 552, Type II, Class 1.

2. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.

C. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in performing insulation to cover valves, elbows, tees, and flanges.

2.3 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.


C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.

2. PVC Jacket Color: White.

3. PVC Jacket Color: Color-code piping jackets based on materials contained within the piping system.

D. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil (0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.
1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
2. Adhesive: As recommended by insulation material manufacturer.

2.4 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz./sq. yd. (270 g/sq. m).
   1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide:
   1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.

C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

2.5 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.3 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply 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. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:
1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply 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 (100 mm) o.c.
   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
   1. Seal penetrations with vapor-retarder mastic.
   2. Apply insulation for exterior applications tightly joined to interior insulation ends.
   3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
   4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.

R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

3.4 MINERAL-FIBER INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:
   1. Secure each layer of preformed pipe insulation to pipe with wire, tape, or bands without deforming insulation materials.
   2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet (4.5 to 6 m) to form a vapor retarder between pipe insulation segments.
   3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
   4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as
recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

5. Apply canvas jacket material with manufacturer’s recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the 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. Apply canvas jacket material with manufacturer’s recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer’s written instructions.
2. When premolded insulation elbows and fittings are not available, apply mitered sections of pipe insulation, or glass-fiber blanket insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer’s attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. Apply canvas jacket material with manufacturer’s recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer’s written instructions.
2. When premolded insulation sections are not available, apply glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
3. Apply insulation to flanges as specified for flange insulation application.
4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer’s attachments and accessories. Seal seams with tape and vapor-retarder mastic.
5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

7. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

3.5 CELLULAR-GLASS INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
5. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.
4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting
covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

D. Apply insulation to valves and specialties as follows:

1. Apply pre-molded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.

2. Apply insulation to flanges as specified for flange insulation application.


4. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

5. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.

3.6 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

   1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
   3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

B. Apply PVC jacket where indicated, with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

C. Apply metal jacket where indicated, with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with waterproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

D. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

3.7 FINISHES
A. Insulation: Paint insulation finished as specified in Division 9 Section "Painting."

B. Color: Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.

3.8 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.
4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.

3.10 FIELD QUALITY CONTROL

A. Inspection: Owner will engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

B. Inspection: Engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

C. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

1. Inspect fittings and valves randomly selected by Owner's Representative.
2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.

D. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

E. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.11 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.12 INSULATION APPLICATION SCHEDULE

A. Refrigerant, Condensate, and Equipment Drain:

1. All Pipe Sizes
2. Insulation Material: Mineral fiber with jacket
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, ¾" – 1": 1"
   b. Copper and steel, 1 ½"-4": 1"
4. Field-Applied Jacket: None Typical; for interior: Provide canvas Jacket; for exterior spaces provide PVC jacket.
5. Vapor Retarder Required: Yes.
6. Finish: None.

B. Heating-Hot-Water Supply and Return, 200 Deg F (93 Deg C) and below:

1. NPS 12 (DN 300) and Smaller: Insulation shall be any of the following:
   a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch (25 mm) thick.

C. Domestic tepid, hot and re-circulated hot water.

1. Operating Temperature: 60 to 140 deg F
2. Insulation Material: Mineral fiber with jacket
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, ¾" – 1": 1"
   b. Copper and steel, 1 ½"-3": 1 ½"
5. Vapor Retarder Required: Yes.
6. Finish: None.

D. Domestic Cold Water

1. Operating Temperature: 55 to 75 deg F
2. Insulation Material: Mineral fiber with jacket.
3. Insulation Thickness: Apply the following insulation thicknesses:
   a. Copper Pipe, 1" – 2": 1"
   b. Steel, 2 1/2" – 4": 1"
5. Vapor Retarder Required: Yes.
6. Finish: None.

END OF SECTION 15083
SECTION 15110 - VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following general-duty valves:

1. Bronze angle valves.
2. Copper-alloy ball valves.
3. Ferrous-alloy ball valves.
4. Ferrous-alloy butterfly valves.
5. Bronze check valves.
6. Ferrous-alloy wafer check valves.
7. Spring-loaded, lift-disc check valves.
8. Bronze globe valves.

B. Related Sections include the following:

1. Division 15 Section "Mechanical Identification" for valve tags and charts.
2. Division 15 Section "HVAC Instrumentation and Controls" for control valves and actuators.
3. Division 15 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list
indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water, sanitary waste, and storm drainage piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. 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 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 (DN 65) and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Ball Valves: Full port type.

G. Valve Actuators:
   1. Gear Drive: For quarter-turn valves NPS 8 (DN 200) and larger.
   2. Handwheel: For valves other than quarter-turn types.
   3. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
   4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

H. Extended Valve Stems: On insulated valves.


J. Valve Grooved Ends: AWWA C606.
   1. Solder Joint: With sockets according to ASME B16.18.
      a. Caution: Use solder with melting point below 840 deg F (454 deg C) for angle, check, gate, and globe valves; below 421 deg F (216 deg C) for ball valves.
   2. Threaded: With threads according to ASME B1.20.1.

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

2.3 COPPER-ALLOY BALL VALVES

A. Manufacturers:
   1. Two-Piece, Copper-Alloy Ball Valves:
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Div.
e. Grinnell Corporation.
f. Hammond Valve.
g. Jamesbury, Inc.
h. Milwaukee Valve Company.
i. NIBCO INC.

B. Copper-Alloy Ball Valves, General: MSS SP-110.

C. Two-Piece, Copper-Alloy Ball Valves: Bronze body with full port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig (4140-kPa) minimum CWP rating and blowout-proof stem.

2.4 FERROUS-ALLOY BALL VALVES

A. Manufacturers:

2. Crane Co.; Crane Valve Group; Stockham Div.
3. Flow-Tek, Inc.
5. Jamesbury, Inc.
7. NIBCO INC.
8. Worcester Controls.

B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

C. Ferrous-Alloy Ball Valves: Class 150, full port.

2.5 FERROUS-ALLOY BUTTERFLY VALVES

A. Manufacturers:

1. Flangeless, Ferrous-Alloy Butterfly Valves:
   b. Crane Co.; Crane Valve Group; Stockham Div.

2. Grooved-End, Ductile-Iron Butterfly Valves:
   b. Crane Co.; Crane Valve Group; Stockham Div.

B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated. Bray High Performance or Crane Flowseal High Performance.
C. Flangeless, 150-psig (1035-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Wafer type with one- or two-piece stem. Bray High Performance or Crane Flowseal High Performance.

D. Grooved-End, 175-psig (1207-kPa) CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends. Bray High Performance or Crane Flowseal High Performance.

2.6 BRONZE CHECK VALVES

A. Manufacturers:

1. Type 2, Bronze, Horizontal Lift Check Valves with Nonmetallic Disc:
   a. Cincinnati Valve Co.
   b. Crane Co.; Crane Valve Group; Crane Valves.
   c. Crane Co.; Crane Valve Group; Jenkins Valves.
   d. Crane Co.; Crane Valve Group; Stockham Div.
   e. Walworth Co.
   f. Type 2, Bronze, Vertical Lift Check Valves with Nonmetallic Disc:
   g. Grinnell Corporation.
   h. Kitz Corporation of America.
   i. Milwaukee Valve Company.

2. Type 4, Bronze, Swing Check Valves with Metal Disc:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Div.
   d. Grinnell Corporation.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.
   h. Watts Industries, Inc.; Water Products Div.

B. Bronze Check Valves, General: MSS SP-80.

C. Type 2, Class 125, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

D. Type 2, Class 125, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.

E. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.

2.7 SWING CHECK VALVES

A. Manufacturers:

1. Grooved-End, Ductile-Iron Swing Check Valves:
a. Grinnell Corporation.
b. Mueller Co.
c. Victaulic Co. of America.

B. 175-psig (1207-kPa) CWP Rating, Grooved-End, Swing Check Valves: Ductile-iron body with grooved or shouldered ends.

2.8 SPRING-LOADED, LIFT-DISC CHECK VALVES

A. Manufacturers:

1. Type I and II, Compact-Wafer, Lift-Disc Check Valves:
   a. Grinnell Corporation.
   b. Hammond Valve.
   c. Milwaukee Valve Company.
   d. NIBCO INC.

2. Type IV, Threaded Lift-Disc Check Valves:
   a. Grinnell Corporation.
   b. Legend Valve & Fitting, Inc.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Watts Industries, Inc.; Water Products Div.

B. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.

C. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.

D. Type II, Class 125, Compact-Wafer, Lift-Disc Check Valves: Compact-wafer style with cast-iron shell with diameter made to fit within bolt circle.

E. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.

2.9 BRONZE GLOBE VALVES

A. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Div.
   d. Grinnell Corporation.
   e. Hammond Valve.
   f. Legend Valve & Fitting, Inc.
   g. Milwaukee Valve Company.
h. NIBCO INC.

2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Jenkins Valves.
   c. Crane Co.; Crane Valve Group; Stockham Div.
   d. Grinnell Corporation.
   e. Hammond Valve.
   f. Milwaukee Valve Company.
   g. NIBCO INC.

B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 125, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet.

D. Type 2, Class 150, Bronze Globe Valves: Bronze body with nonmetallic PTFE or TFE disc and union-ring bonnet.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

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

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
1. Shutoff Service: Ball, or plug valves.
2. Throttling Service: Ball, butterfly, or globe valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Heating, Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: Two piece, 400-psig (2760-kPa) CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
3. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flangeless 150-psig (1035-kPa) CWP rating, ferrous alloy, with EPDM liner.
4. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) CWP rating.
5. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 125 horizontal or vertical, bronze.
6. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type 4, Class 150, bronze.
8. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) CWP rating.
9. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 125 minimum.
10. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.
11. Globe Valves, NPS 2-1/2 (DN 65) and Larger: Type I, Class 125, bronze-mounted cast iron.
12. Plug Valves, NPS 2 (DN 50) and Larger: Class 125 or 150, nonlubricated-type, cast iron.

D. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 (DN 50) and Smaller: Two-piece, 400-psig (2760-kPa) CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 (DN 65) and Larger: Class 150, ferrous alloy.
3. Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: Flangeless 150-psig (1035-kPa) CWP rating, ferrous alloy, with EPDM liner.
4. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) CWP rating.
5. Lift Check Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 125 horizontal or vertical, bronze.
6. Swing Check Valves, NPS 2 (DN 50) and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: Type 4, Class 150, bronze.
8. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 (DN 65) and Larger: 175-psig (1207-kPa) CWP rating.
9. Spring-Loaded, Lift-Disc Check Valves, NPS 2 (DN 50) and Smaller: Type IV, Class 125 minimum.
10. Spring-Loaded, Lift-Disc Check Valves, NPS 2-1/2 (DN 65) and Larger: Type I or II Class 125, cast iron.
11. Globe Valves, NPS 2 (DN 50) and Smaller: Type 2, Class 150, bronze.

E. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water services.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged ends.
4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded ends.
6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged ends.
7. For Grooved-End, Copper Tubing and Steel Piping: Valve ends may be grooved. Do not use for steam or steam condensate piping.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15110
SECTION 15120 - PIPING SPECIALITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pressure gages.
   2. Pressure gage taps.
   3. Thermometers.
   4. Thermometer supports.
   5. Test plugs.
   7. Pump suction fittings.
   8. Orifice flowmeters.
   9. Relief valves.
  10. Air Vents.

B. Related Sections:
   1. Section 15180 - Heating Water Piping: Execution requirements for piping connections to products specified by this section.
   2. Section 15185 - Pumps: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
   1. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
   2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

B. ASTM International:

C. American Water Works Association:
1. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
2. AWWA C702 - Cold-Water Meters - Compound Type.
3. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.

D. Underwriters Laboratories Inc.:

1. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
2. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

1.3 PERFORMANCE REQUIREMENTS

A. Flexible Connectors: Provide at or near pumps compressors and motorized equipment where piping configuration does not absorb vibration.

1.4 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit for manufactured products and assemblies used in this Project.

1. Manufacturer's data and list indicating use, operating range, total range, accuracy, and location for manufactured components.
2. Submit product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each piping specialty.
4. Submit electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures, application, selection, and hookup configuration. Include pipe and accessory elevations.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 01700 - Execution Requirements: Closeout procedures.

B. Project Record Documents: As-Built Record drawings indicting actual locations of actual locations of components and instrumentation.

C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list.
1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Accept piping specialties on site in shipping containers with labeling in place. Inspect for damage.

C. Provide temporary protective coating on cast iron and steel valves.

D. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.9 FIELD MEASUREMENTS

A. Verify field measurements before fabrication.

1.10 WARRANTY

A. Section 01700 - Execution Requirements: Product warranties and product bonds.

B. Furnish one year manufacturer warranty for piping specialties.

1.11 MAINTENANCE SERVICE

A. Section 01700 - Execution Requirements: Maintenance service.

1.12 MAINTENANCE MATERIALS

A. Section 01700 - Execution Requirements: Spare parts and maintenance materials.

B. Furnish two bottles of red gage oil for static pressure gages.
PART 2 - PRODUCTS

2.1 THERMOMETERS (Solar Digital)

A. Manufacturers:

1. Ernst Gage Co.
2. Eugene Ernst Products Co.
3. Marsh Bellofram.
4. Trerice, H. O. Co.
5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

B. Model SX9 by H. O. Trerice Co.

C. Case: Aluminum, 7 inches long.

D. Digital display, LCD switchable between F and C.

E. Sensor: Glass passivated thermistor

F. Window: Glass or plastic.

G. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

H. Stem: Metal, for thermowell installation and of length to suit installation.

1. Accuracy: Plus or minus 1 percent of range or plus or maximum of 1.5 percent of range.

2.2 DUCT-TYPE, LIQUID-IN-GLASS THERMOMETERS

A. Manufacturers:

1. Miljoco Corp.
2. Palmer - Wahl Instruments Inc.
3. Trerice, H. O. Co.
4. Weiss Instruments, Inc.

B. Case: Metal or plastic, 7 inches (178 mm) long.

C. Tube: Red or blue reading, organic filled, with magnifying lens.

D. Tube Background: Satin-faced, nonreflective aluminum with permanently etched scale markings.

E. Window: Glass or plastic.

F. Connector: Adjustable type, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

G. Stem: Metal, for installation in mounting bracket and of length to suit installation.
H. Mounting Bracket: Flanged fitting for attachment to duct and made to hold thermometer stem.

I. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers:
   1. AMETEK, Inc.; U.S. Gauge Div.
   3. Ernst Gage Co.
   5. Tel-Tru Manufacturing Company.
   7. Weiss Instruments, Inc.
   8. 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.

2.4 PRESSURE GAGES

A. Manufacturers:
   1. AMETEK, Inc.; U.S. Gauge Div.
   3. Marsh Bellofram.
   4. T terce, H. O. Co.
   5. Weiss Instruments, Inc.
   6. 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, 6-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.
   7. Window: Glass or plastic.
   8. Ring: Metal.
9. Accuracy: Grade B, plus or minus 2 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.

2.5 TEST PLUGS

A. Manufacturers:
   1. Flow Design, Inc.
   2. MG Piping Products Co.
   4. Peterson Equipment Co., Inc.
   5. Trerice, H. O. Co.

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 containing one pressure gage and adaptor, two 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.
F. Socket: Brass separable sockets for thermometer stems with or without extensions, and with cap and chain.

G. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.6 STRAINERS

A. Size 2 inch and Smaller:
   1. Screwed brass or iron body for 175 psig working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:
   1. Flanged iron body for 175 psig working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.7 PUMP SUCTION FITTINGS

A. Manufacturers:
   1. ITT Bell Gossett
   2. Taco MFG Co.
   3. Armstrong Pumps
   4. Or Approved Equal

B. Fitting: Angle pattern, cast-iron body. Threaded for 2 inch (50 mm) and smaller, flanged for 2-1/2 inch (65 mm) and larger. Rated for 175 psig (1200 kPa) working pressure, with inlet vanes, cylinder strainer with 3/16 inch (5 mm) diameter openings, disposable fine mesh strainer to fit over cylinder strainer, and permanent magnet located in flow stream and removable for cleaning.

C. Accessories: Adjustable foot support, blow-down tapping in bottom, gage tapping in side.

2.8 PRESSURE REDUCING VALVES

A. Manufacturers:
   1. Watts
   2. Zurn
   3. Keystone
   4. Or Approved Equal

B. Bronze body, stainless or chrome steel valve spring, stem, and trim, phosphor bronze diaphragm, direct acting, threaded 2 inches (50 mm) and smaller, flanged 2 inches (50 mm) and larger.
2.9 AIR VENTS

A. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150-psig working pressure; 240 deg F operating temperature; with NPS ¼ discharge connection and NPS ½ inlet connection.

2.10 SAFETY RELIEF VALVES

A. Manufacturers:
   1. Watts
   2. Zurn
   3. Keystone
   4. Or Approved Equal

B. Valve: Bronze body, stainless steel valve spring, stem, and trim, direct pressure actuated, capacities ASME certified and labeled.

C. Accessories: Drip-pan elbow.

PART 3 - EXECUTION

3.1 INSTALLATION - THERMOMETERS AND GAGES

A. Install pressure gages for each pump, locate on taps before strainers and on suction and discharge of pump; a minimum of three gages.

B. Install gage taps in piping

C. Install pressure gages with pulsation dampers. Provide ball valve to isolate each gage. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches (65 mm) for installation of thermometer sockets. Allow clearance from insulation.

E. Install thermometers in air duct systems on flanges.

F. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

G. Locate duct-mounted thermometers minimum 10 feet (3 m) downstream of mixing-dampers, coils, or other devices causing air turbulence.

H. Coil and conceal excess capillary on remote element instruments.

I. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.
J.  Provide instruments with scale ranges selected according to service with largest appropriate scale.

K.  Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

L.  Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2 INSTALLATION - HYDRONIC PIPING SPECIALTIES

A.  Locate test plugs adjacent to thermometers and thermometer sockets as indicated on Drawings.

B.  Where large air quantities accumulate, provide enlarged air collection standpipes.

C.  Install manual air vents at system high points.

D.  For automatic air vents in ceiling spaces or other concealed locations, install vent tubing to nearest drain.

E.  Provide air separator on suction side of system circulation pump and connect to expansion tank.

F.  Provide drain and hose connection with valve on strainer blow down connection.

G.  Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove temporary strainers after cleaning systems.

H.  Provide combination pump discharge valve on discharge side of base mounted centrifugal pumps.

I.  Support pump fittings with floor mounted pipe and flange supports.

J.  Provide radiator valves on water inlet for the following terminal heating unit types: radiation, unit heaters, and fan coil units.

K.  Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.

L.  Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

M.  Pipe relief valve outlet to nearest floor drain.

N.  Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
3.3 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

3.4 FIELD QUALITY CONTROL

A. Section 01400 - Quality Requirements: Testing and Inspection Services 01700 - Execution Requirements: Testing, adjusting, and balancing.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01700 - Execution Requirements: Requirements for protecting installed construction.

B. Remove thermostatic elements from steam traps during temporary and trial usage, and until system has been operated and dirt pockets cleaned of sediment and scale.

C. Do not install hydronic pressure gauges until after systems are pressure tested.

END OF SECTION 15120
SECTION 15140 - DOMESTIC & HEATING WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

1.2 SUBMITTALS


1.3 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components-Health Effects: Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Transition Couplings: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with piping to be joined.

B. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.


2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.2 VALVES AND SPECIALTIES

A. Refer to Division 15 Section "Valves" for bronze and cast-iron, general-duty valves.

B. Refer to Division 15 Section "Plumbing Specialties" for balancing and drain valves.
PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Domestic Water Piping: Use the following piping materials for each size range:

1. 2 1/2" and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

3.2 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller.

B. Isolation valves at all fixtures shall be required to allow equipment isolation from domestic water service main for maintenance and repair.

3.3 PIPING INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Install water piping level without pitch and plumb.

C. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

D. Perform appropriate start-up measures for Anne Arundel prior to system operation.

E. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

F. Check plumbing specialties and verify proper settings, adjustments, and operation.

1. Water-Pressure Regulators: Set outlet pressure at 80 psig (550 kPa) maximum, unless otherwise indicated.

G. Energize pumps and verify proper operation.
3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 VALVE INSTALLATION

A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
   1. Install hose-end drain valves at low points in water mains, risers, and branches.
   2. Install stop-and-waste drain valves where indicated.

3.6 HANGER AND SUPPORT INSTALLATION

A. Install supports according to Division 15 Section "Hangers and Supports."

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch (10 mm).

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

   1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
   3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   4. NPS 2-1/2: 108 inches with 1/2-inch rod.
   5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

E. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

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

B. Install piping adjacent to equipment and machines to allow service and maintenance.
C. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:

1. Fixtures: Cold-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow standing for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action. Test reports shall indicate section of the piping system tested with a drawing representation of tested areas, duration of test, pressures maintained, repair work performed with location shown on drawings, and signature of project superintendent affirming that the system has passed the testing process in accordance with the specification.
3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
   1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
   2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Fill and isolate system according to either of the following:
         1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
         2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
      c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140
SECTION 15183 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-22:

1.3 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.4 QUALITY ASSURANCE


B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.5 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L.

B. Wrought-Copper Fittings: ASME B16.22.
C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

F. Flexible Connectors:
   2. End Connections: Socket ends.
   3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch long assembly.
   5. Maximum Operating Temperature: 250 deg F.

2.2 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Atofina Chemicals, Inc.
   2. DuPont Company; Fluorochemicals Div.
   3. Honeywell, Inc.; Genetron Refrigerants.
   4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-22: Monochlorodifluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed joints.

B. Suction Lines NPS 4 and smaller for Conventional Air-Conditioning Applications: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.

C. Hot-Gas and Liquid Lines: Copper, Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

D. Hot-Gas and Liquid Lines:
1. NPS 1-1/2 and Smaller: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.

2. NPS 2 to NPS 3: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.

3. NPS 4: Copper, Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

E. Safety-Relief-Valve Discharge Piping: Copper, Type K, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Refer to Division 15 Sections "HVAC Instrumentation and Controls" and "Sequence of Operation" for solenoid valve controllers, control wiring, and sequence of operation.

K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 8 Section "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor.
   3. Install traps and double risers to entrain oil in vertical runs.
   4. Liquid lines may be installed level.

P. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves according to Division 15 Section "Mechanical Identification."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 15 Section "Sleeves and Sleeve Seals for HVAC Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 15 Section "Sleeves and Sleeve Seals for HVAC Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 15 Section "Escutcheons for HVAC Piping."

3.3 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
   1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
   2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.
3.4 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Division 15 Section "Hangers and Supports."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Spring hangers to support vertical runs.
4. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
   a. Fill system with nitrogen to the required test pressure.
   b. System shall maintain test pressure at the manifold gage throughout duration of test.
   c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
   d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
3.6 SYSTEM CHARGING

A. Charge system using the following procedures in accordance with HVAC equipment manufacturer's recommendations:
   1. Install core in filter dryers after leak test but before evacuation.
   2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
   3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
   4. Charge system with a new filter-dryer core in charging line.

3.7 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
   1. Open shutoff valves in condenser water circuit.
   2. Verify that compressor oil level is correct.
   3. Open compressor suction and discharge valves.
   4. Open refrigerant valves except bypass valves that are used for other purposes.
   5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 15183
SECTION 15185 - HYDRONIC PUMPS

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. Magnetic sealless pumps.

1.3 SUBMITTALS

A. Product Data: Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: Show pump layout and connections. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.


C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hydronic pumps through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of hydronic pumps and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements.”

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing.
Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

B. Store pumps in dry location.

C. Retain protective covers for flanges and protective coatings during storage.

D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

E. Comply with pump manufacturer's written rigging instructions.

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 3.

PART 2 - PRODUCTS

2.1 MAGNETIC SEALLESS PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Finish Thompson Inc. (Basis of Design).
2. Approved Equal

B. Description: Factory-assembled and -tested, centrifugal, close-coupled, chemical resistant pump with magnetic sealless drive, requiring no seals in contact with the pumped fluid.

C. Pump Construction:

1. Casing: Chemical resistant with threaded connections, suitable for pool water up to 120 F and boiler water up to 200 F.
2. Impeller: Statically and dynamically balanced. For constant-speed pumps, trim impeller to match specified performance.
3. Rugged cantilevered ceramic spindle.
4. 24 hour run-dry capability with carbon bushing.

D. Motor: Single speed and rigidly mounted to pump casing.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Division 15 Section "Motors."

a. Enclosure: Open, dripproof.
c. Motor Bearings: Permanently lubricated ball bearings.

E. Capacities and Characteristic:

1. See Drawings for schedules

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

B. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pump to allow service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install pressure gages on pump suction and discharge.

F. Install electrical connections for power, controls, and devices.

G. Ground equipment according to Division 16 section "Grounding".

H. Connect wiring according to Division 16.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:
   a. Verify bearing lubrication.
   b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
   c. Verify that pump is rotating in the correct direction.
5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Open discharge valve slowly.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 15185
SECTION 15430 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the following plumbing specialties:
   1. Water regulators.
   2. Backflow preventors.
   4. Strainers.
   5. Miscellaneous piping specialties.

1.2 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:
   1. Domestic Water Piping: 125 psig (860 kPa).

1.3 SUBMITTALS

A. Product Data: Include rated capacities and indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping and wiring connections for the following:
   1. Back Flow Preventer

B. Field quality-control test reports.

C. Operation and maintenance data for the following:
   1. Water regulators.
   2. Back Flow Preventer

1.4 QUALITY ASSURANCE

A. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

C. NSF Compliance:
PART 2 - PRODUCTS

2.1 BACKFLOW PREVENTERS

A. General: ASSE standard, backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.

1. 2-Inch NPS (DN50) and Smaller: Bronze body with threaded ends.

B. Back Flow Preventer shall be as Manufactured by WATTs, Industries, Zurn, Grinnell, or approved equal.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with non-removable and manual drain features, and ASME B1.20.7 garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between 2 positive-seating check valves.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

C. Install wood-blocking reinforcement for wall-mounting plumbing specialties.

D. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

E. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.
B. Connect plumbing specialties and devices that require power according to Division 16 Sections.

3.3 PROTECTION

A. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15430
SECTION 15672 - AIR-COOLED REFRIGERANT CONDENSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, air-cooled refrigerant condensers for outdoor installation.

1.2 SUBMITTALS

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

B. Shop Drawings: For air-cooled refrigerant condensers. 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. Operation and maintenance data.

1.3 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ROC (Basis of Design).

2. Or Approved Equal.

2.2 MANUFACTURED UNITS

A. Description: Factory assembled and tested; consisting of casing, condenser coils, condenser fans and motors, and unit controls.

B. Refrigerant: R-410A.

C. Condenser Coil: Factory tested at 425 psig (2930 kPa).
1. The coil shall be constructed of copper tubing in a staggered design. Tubes shall be hydraulically expanded into full-collared, plate-type aluminum fins. Coils shall be factory leak-tested and sealed with caps.

2. Circuit: To match compressors.

D. Condenser Fans and Drives: Propeller fans with aluminum or galvanized-steel fan blades, for vertical air discharge; directly driven with permanently lubricated ball-bearing motors with integral current- and thermal-overload protection.

1. Weather-proof motors with rain shield and shaft slinger.

E. Operating and Safety Controls: Include condenser fan motor thermal and overload cutouts; 115-V control transformer, if required; magnetic contactors for condenser fan motors and a nonfused factory-mounted and -wired disconnect switch for single external electrical power connection.

1. Fan Cycling Control: Head pressure switches.

F. Casings: Aluminum, designed for outdoor installation with weather protection for components and controls, and with the following:

1. Fan guards: heavy-gauge, closed-mesh steel wire with vinyl coating.
2. Lifting eyes.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Motors."

2.4 SOURCE QUALITY CONTROL

A. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
B. Install piping adjacent to machine to allow service and maintenance.

C. Refrigerant Piping: Connect piping to unit with pressure relief, service valve, filter-dryer, and moisture indicator on each refrigerant-circuit liquid line. Refrigerant piping and specialties are specified in Division 15 Section "Refrigerant Piping."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Perform electrical test and visual and mechanical inspection.
   2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Complete manufacturer's starting checklist.
   4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

D. Air-cooled refrigerant condensers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 15672
SECTION 15732 – PACKAGED ROOFTOP AIR CONDITIONING UNITS

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 packaged, outdoor, central-station air-handling units (rooftop units) with the following components and accessories:

   1. Direct-expansion cooling.
   3. Hot-gas reheat.
   4. Economizer outdoor- and return-air damper section with integral Air-to-air heat exchanger
   5. Integral, space temperature controls.
   6. Roof curb

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

B. ECM: Electrically commutated motor.

C. Outdoor-Air Refrigerant Coil: Refrigerant coil in the outdoor-air stream to reject heat during cooling operations and to absorb heat during heating operations. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

D. Outdoor-Air Refrigerant-Coil Fan: The outdoor-air refrigerant-coil fan in RTUs. "Outdoor air" is defined as the air outside the building or taken from outdoors and not previously circulated through the system.

E. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, outdoor, central-station air-handling units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

F. Supply-Air Fan: The fan providing supply air to conditioned space. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.

G. Supply-Air Refrigerant Coil: Refrigerant coil in the supply-air stream to absorb heat (provide cooling) during cooling operations and to reject heat (provide heating) during heating operations. "Supply air" is defined as the air entering a space from air-conditioning, heating, or ventilating apparatus.
1.4 SUBMITTALS

A. Product Data: Include manufacturer’s technical data for each RTU, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

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.

C. Coordination Drawings: 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
   3. Roof curbs and flashing.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. ARI Compliance:
   1. Comply with ARI 210/240 and ARI 340/360 for testing and rating energy efficiencies for RTUs.
   2. Comply with ARI 270 for testing and rating sound performance for RTUs.

B. ASHRAE Compliance:
   1. Comply with ASHRAE 15 for refrigeration system safety.
   2. Comply with ASHRAE 33 for methods of testing cooling and heating coils.

C. NFPA Compliance: Comply with NFPA 90A and NFPA 90B.


E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of RTU that fail in materials or workmanship within specified warranty period.

1. Comprehensive Warranty on parts and labor for 1 year following substantial completion
2. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
3. Warranty Period for Airside Coils with ElectroFin E-Coating: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

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. Fan Belts: One set for each belt-driven fan.
2. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings (DesertAire SAE30) or a comparable product by one of the following:

1. PoolPak.
2. Dectron.

D. When substituting a product for the Basis of Design, the contractor takes full responsibility for all coordination with existing conditions and associated construction costs of all trades.
2.2 GENERAL

A. General: The unit shall be a heavy-duty, commercial / industrial grade, heat recovery dehumidification system. It is to be completely assembled and factory tested. The unit must include the following minimum parts and components: compressor(s), evaporator (dehumidifier) coil, full-capacity condenser (hot gas reheat) coil, blower, blower motor, refrigeration valves, water-cooled condensers, and electrical controls.

1. The unit shall be constructed with staged, dual refrigeration circuits. Single circuit systems will not be allowed. Each circuit shall contain a dehumidifier coil and a full-capacity hot gas reheat coil that can be controlled to provide simultaneous or independent heat rejection.

2. The system shall reject heat to the following additional condenser(s) with the corresponding purpose:

   a. Reheat, Water, and Remote Condenser Ready: (Circuit A and / or Circuit B). This design combines all the heat sink options. Heat will be directed to one of the following; to the air on a call for air heat; to the water on a call for water heat; to a remote condenser on a call for air cooling.

B. Modes of Operation: In the dehumidification process, energy is transferred from the room air to the refrigerant as it passes through the evaporator coils. The air, having been cooled below its dewpoint, will condense moisture as it passes through the cold evaporator coil. The resulting energy generated by this condensing process, along with the power consumption of the compressor, is given up as sensible heat by the respective condensers (air reheat coils, water heating condensers) to be distributed as required. The system shall introduce make-up air between the evaporator coil and the hot gas reheat coil.

1. The system consists of dual, independent refrigeration circuits. These refrigeration circuits can operate independently or simultaneously and are staged to match the loads and maximize the energy recovery process by utilizing the appropriate "heat sinks." Compressor unloading will not be accepted.

C. Sequence of Operation: The dehumidifier shall maintain its moisture removal capacity in all modes of operation, as specified in the unit schedule. Controls shall automatically operate the dehumidification heat recovery system in response to system requirements and adjust its output to maintain specified conditions. The heat recovery unit shall be capable of rejecting the total heat of rejection (THR) to the air for space heating (reheat), to a remote air-cooled outdoor condenser on a call for air cooling or to a water-cooled condenser/water loop.

2.3 CASING

A. General Fabrication Requirements for Casings. Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.
B. Exterior Casing Material: Galvanized steel with factory-painted finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.

1. Exterior Casing Thickness: 16 gauge.

C. Casing Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

1. Materials: ASTM C 1071, Type I.
2. Thickness: 1 inch (25 mm).
3. Liner materials shall have air-stream surface coated with an erosion- and temperature-resistant coating or faced with a plain or coated fibrous mat or fabric.
4. Liner Adhesive: Comply with ASTM C 916, Type I.

D. Condensate Drain Pans: Formed sections of stainless-steel sheet, a minimum of 2 inches (50 mm) deep.

1. Drain Connections: Threaded nipple.

2.4 FANS

A. Belt-Driven Supply-Air Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable fan base resiliently mounted in the casing. Aluminum or painted-steel wheels, and galvanized- or painted-steel fan scrolls.

B. Relief-Air Fan: Forward curved, shaft mounted on permanently lubricated motor.

C. Fan Motor: Comply with requirements in Division 15 Section "Motors."

2.5 REFRIGERANT COILS

A. Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.


B. ElectroFin E-Coating: Coat coils with ElectroFin E-coating to resist chemicals and corrosion. The coating will be applied to the entire coil assembly. The coil will be sealed, electro-statically charged, coated and baked.

2.6 POOL WATER-COOLED CONDENSER

A. The condenser shall be tube-in-tube, cupronickel construction with CPVC stub-outs.

B. The size and capacity of the water-cooled condenser shall as needed to reject the Total Heat Rejected of the provided unit.
C. The condenser shall be wrapped in insulation and heat traced. The heat tracing shall be wired back to the single main power connection as well as the internal control panel for operation.

2.7 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.

B. Compressor: Hermetic, scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

C. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
5. Automatic-reset low-pressure safety switch.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
11. Hot-gas bypass solenoid valve with a replaceable magnetic coil.
12. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.8 AIR FILTRATION

A. Minimum arrstance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.

1. Pleated: Minimum MERV 8 4" pleated filter.

2.9 DAMPERS

A. Parallel- or opposed-blade galvanized-steel dampers mechanically fastened to cadmium plated for galvanized-steel operating rod in reinforced cabinet.

1. Damper Motor: Modulating with adjustable minimum position.

2.10 ELECTRICAL POWER CONNECTION

A. Provide for single connection of power to unit with miscellaneous power and control-circuit transformer with built-in overcurrent protection.

2.11 CONTROLS

A. DDC Controller:
1. Controller shall have volatile-memory backup.
2. Safety Control Operation:
   a. Smoke Detectors: Stop fan and close outdoor-air damper if smoke is detected. Provide additional contacts for alarm interface to fire alarm control panel.
   b. Firestats: Stop fan and close outdoor-air damper if air greater than 130 deg F enters unit. Provide additional contacts for alarm interface to fire alarm control panel.
   d. Low-Discharge Temperature: Stop fan and close outdoor-air damper if supply air temperature is less than 40 deg F.
   e. Defrost Control for Condenser Coil: Pressure differential switch to initiate defrost sequence.
3. Scheduled Operation: scheduled through interface with the existing campus control system.
   a. Heating Setback: 10 deg F adjustable.
   c. Override Operation: Two hours adjustable.
4. Supply Fan Operation:
   a. Occupied Periods: Run fan continuously.
   b. Unoccupied Periods: Cycle fan to maintain setback temperature.
5. Refrigerant Circuit Operation:
   a. Occupied Periods: Cycle or stage compressors, and operate hot-gas bypass to match compressor output to cooling load to maintain space temperature and humidity. Cycle condenser fans to maintain maximum hot-gas pressure. Operate low-ambient control kit to maintain minimum hot-gas pressure.
   b. Unoccupied Periods: Cycle compressors and condenser fans for heating to maintain setback temperature.
   c. Switch reversing valve for heating or cooling mode on air-to-air heat pump.
6. Hot-Gas Reheat-Coil Operation:
   a. Occupied Periods: Humidistat opens hot-gas valve to provide hot-gas reheat, and cycles compressor.
   b. Unoccupied Periods: Reheat not required.
7. Carbon Dioxide Sensor Operation:
   a. Occupied Periods: Reset minimum outdoor-air ratio down to minimum 10 percent to maintain maximum 1000-ppm concentration.
   b. Unoccupied Periods: Close outdoor-air damper and open return-air damper.
B. Interface Requirements for HVAC Instrumentation and Control System:

1. Interface relay for scheduled operation.
2. Interface relay to provide indication of fault at the central workstation and diagnostic code storage.
3. Provide control interface for central HVAC control workstation compatible with existing Johnson Metasys for the following:
   a. Adjusting set points.
   b. Monitoring supply fan start, stop, and operation.
   c. Inquiring data to include outdoor-air damper position, supply- and room-air temperature and humidity.
   d. Monitoring occupied and unoccupied operations.
   e. Monitoring variable-frequency drive operation.
   f. Monitoring cooling load.
   g. Monitoring economizer cycles.
   h. Monitoring air-distribution static pressure and ventilation air volume.

2.12 ACCESSORIES

A. Low-ambient kit using variable-speed condenser fans for operation down to 40 deg F.

B. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

2.13 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards (Existing curb may be re-used).
   1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
      a. Materials: ASTM C 1071, Type I or II.
      b. Thickness: 1 inch.

B. Curb Height: 14 inches.

C. It may be possible that basis of design manufacturer unit could be provided with use of the existing curb. Contractor must field verify.

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 RTUs.
B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure, level and secure. Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction. Secure RTUs to upper curb rail, and secure curb base to roof framing.

3.3 CONNECTIONS

A. Install condensate drain, minimum connection size, with trap.

B. Install piping adjacent to RTUs to allow service and maintenance.

C. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts.

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. Report results in writing.

B. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to compressor, coils, and fans.
3. Inspect internal insulation.
4. Verify that labels are clearly visible.
5. Verify that clearances have been provided for servicing.
6. Verify that controls are connected and operable.
7. Verify that filters are installed.
8. Clean condenser coil and inspect for construction debris.
9. Remove packing from vibration isolators.
10. Inspect operation of all dampers.
11. Verify lubrication on fan and motor bearings.
12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.

a. Start refrigeration system.

b. Do not operate below recommended low-ambient temperature.

c. Complete startup sheets and attach copy with Contractor's startup report.

15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.
17. Calibrate thermostats.
18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

a. Coil leaving-air, dry- and wet-bulb temperatures.

b. Coil entering-air, dry- and wet-bulb temperatures.

c. Outdoor-air, dry-bulb temperature.

d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

a. Supply-air volume.

b. Return-air volume.

c. Relief-air volume.

d. Outdoor-air intake volume.

23. Simulate maximum cooling demand and inspect the following:

a. Compressor refrigerant suction and hot-gas pressures.

b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

24. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
b. Low-temperature safety operation.
c. Filter high-pressure differential alarm.
d. Economizer to minimum outdoor-air changeover.
e. Relief-air fan operation.
f. Smoke and firestat alarms.

25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.6 CLEANING AND ADJUSTING

A. After completing system installation and testing, adjusting, and balancing RTU and air-distribution systems, clean filter housings and install new filters.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain RTUs. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 15732
SECTION 15761 - AIR COILS

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 types of air coils that are not an integral part of air-handling units:

1. Hot-water.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each air coil. Include rated capacity and pressure drop for each air coil.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For air coils to include in 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.

PART 2 - PRODUCTS

2.1 WATER COILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Heatcraft (Basis of Design)
2. Aerofin Corporation.
3. Carrier Corporation.
4. Trane.
5. USA Coil & Air.
6. Or Approved Equal.

B. Performance Ratings: Tested and rated according to ARI 410 and ASHRAE 33.

C. Minimum Working-Pressure/Temperature Ratings: 200 psig (1380 kPa), 325 deg F (163 deg C).

D. Source Quality Control: Factory tested to 300 psig (2070 kPa).

E. Tubes: ASTM B 743 copper, minimum 0.035 inch (0.889 mm thick).

F. Fins: Aluminum, minimum 0.010 inch (0.254 mm) thick.

G. ElectroFin E-Coating: Coat coils with ElectroFin E-coating to resist chemicals and corrosion. The coating will be applied to the entire coil assembly. The coil will be sealed, electro-statically charged, coated and baked.

H. Headers: Brazed copper with air vent and drain tappings.

I. Frames: Galvanized-steel channel frame, minimum 0.064 inch (1.6 mm thick for slip-in or flanged mounting, see drawings for locations, slip in for Air Handling Unit mounting and flanged for duct mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine ducts, plenums, and casings to receive air coils for compliance with requirements for installation tolerances and other conditions affecting coil performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before coil installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coils level and plumb.

B. Install coils in metal ducts and casings constructed according to SMACNA's "HVAC Duct Construction Standards, Metal and Flexible."
C. Straighten bent fins on air coils.

D. Clean coils using materials and methods recommended in writing by manufacturers, and clean inside of casings and enclosures to remove dust and debris.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to coils to allow service and maintenance.

C. Connect water piping with unions and shutoff valves to allow coils to be disconnected without draining piping. Control valves are specified in Division 15 Section "Facility Management System" and other piping specialties are specified in Division 15 Section "Piping Specialties."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION 15761
SECTION 15762 - UNIT HEATERS

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. Section Includes:

1. Propeller unit heaters with electric-resistance heating coils.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

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.

C. Field quality-control test reports.

D. Operation and maintenance data.

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. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2004, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."


PART 2 - PRODUCTS

2.1 ELECTRIC PROPELLER UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dayton (Basis of Design).
2. Airtherm; a Mestek Company.
3. Engineered Air Ltd.
5. Rosemex Products.
6. Ruffneck Heaters; a division of Lexa Corporation.
7. Trane.
8. Or Approved Equal.

B. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

C. Comply with UL 2021.

D. Cabinet: Removable panels for maintenance access to controls.

E. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.

F. Discharge Louver: Adjustable fin diffuser for horizontal units.

G. Electric-Resistance Heating Elements: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with firs no closer than 0.16 inch (4 mm). Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F (288 deg C) at any point during normal operation.

2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

H. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

I. Fan Motors: Permanently lubricated

J. Control Devices: Wall-mounting thermostat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers. Hanger rods and attachments to structure are specified in Division 15 Section "Hangers and Supports." Vibration hangers are specified in Division 15 Section "Mechanical Sound and Vibration Control."
3.2 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. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. 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.

END OF SECTION 15762
SECTION 15815 - METAL DUCTS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round spiral-seam ducts and formed fittings.
3. Double-wall, round spiral-seam ducts and formed fittings.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.


1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Shop Drawings: CAD-generated and drawn 1/4 inch equals 1 foot (1:50) scale. Show fabrication and installation details for metal ducts.

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Duct layout indicating sizes and pressure classes.
3. Elevations of top and bottom of ducts.
4. Dimensions of main duct runs from building grid lines.
5. Fittings.
6. Reinforcement and spacing.
7. Seam and joint construction.
8. Penetrations through fire-rated and other partitions.
9. Equipment installation based on equipment being used on Project.
10. Duct accessories, including access doors and panels.
11. Hangers and supports, including methods for duct and building attachment, vibration isolation, and seismic restraints.

B. Field quality control test reports.

C. Product Data for air devices:
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.

1.6 QUALITY ASSURANCE

A. NFPA Compliance:
   1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
   2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."


PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 (Z180) coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
C. Aluminum Sheets: ASTM B 209 (ASTM B 209M), alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

E. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 SEALANT MATERIALS

A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.

B. Joint and Seam Tape: 2 inches (50 mm) wide; glass-fiber-reinforced fabric.

C. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

D. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

2.4 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

3. Galvanized-steel straps attached to aluminum ducts shall have contact surfaces painted with zinc-chromate primer.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
   3. Supports for Aluminum Ducts: Aluminum support materials unless materials are electrolytically separated from ducts.

2.5 RECTANGULAR DUCT FABRICATION (DOUBLE WALL ALUM. STEEL for OUTDOOR INSTALLATION)

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
   1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
   2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
   1. Available Manufacturers:
      a. Ductmate Industries, Inc.
      b. Nexus Inc.
      c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
   1. Available Manufacturers:
      a. Ductmate Industries, Inc.
      b. Lockformer.

   2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
   3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.
2.6 GRILLES AND REGISTERS:

A. Heavy duty bar return grilles:

1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to:

   a. Carnes.
   b. Krueger.
   c. Nailor Industries of Texas Inc.
   d. Price Industries.
   e. Titus (Model 63FL Basis of Design).

3. Finish: Baked enamel, standard white.
4. Face Arrangement: ½” blade spacing, 30 degree fixed deflection, blades parallel to long dimension.
5. Frame: 1.4 inch wide.

B. 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 - UTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts (before Air Terminal Units): 4-inch wg.
2. Supply Ducts (after Air Terminal Units): 2-inch wg.
5. Outside Air Ducts (Negative Pressure): 2-inch wg.

B. Ducts shall be galvanized steel with a minimum thickness of 24 gauge with the following exceptions:

1. Exposed or exterior duct shall be galvanized steel minimum 18 gauge.
2. Basement mounted duct shall be aluminum.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA’s "HVAC Duct Construction Standards—Metal and Flexible," unless otherwise indicated.

B. Install round ducts in lengths not less than 12 feet unless interrupted by fittings.
C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to not pass through electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant.

O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

Q. Paint exterior of metal ducts, which are exposed in finished spaces. Apply one coat of, latex finish coat over a compatible galvanized-steel primer.
R. Paint interiors of metal ducts, which do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer.

3.3 GRILLE INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

3.4 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
   1. For pressure classes lower than 2-inch wg, seal transverse joints.

B. Seal ducts before external insulation is applied.

3.5 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

D. Install concrete inserts before placing concrete.

E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:
   1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test
entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.

4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.8 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scroills, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:
1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.9 CLEANING EXISTING SYSTEMS

A. Use service openings, as required, for physical and mechanical entry and for inspection.
   1. Use existing service openings where possible.
   2. Create other openings to comply with duct standards.
   3. Disconnect flexible ducts as needed for cleaning and inspection.
   4. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.
   5. Remove and reinstall ceiling sections to gain access during the cleaning process.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

C. Particulate Collection and Odor Control:
   1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.
   2. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans,
humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide operative drainage system for washdown procedures.
7. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.

F. Cleanliness Verification:

1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
2. Visually inspect metal ducts for contaminants.
3. Where contaminants are discovered, re-clean and reinspect ducts.

G. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

END OF SECTION 15815
SECTION 15838 - POWER VENTILATORS

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. Sidewall ventilators.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

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.

C. Field quality-control test reports.

D. Operation and maintenance data.

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. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

C. UL Standard: Power ventilators shall comply with UL 705.

1.5 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
PART 2 - PRODUCTS

2.1 SIDEWALL VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Greenheck. (Basis of Design)
   2. Carnes Company HVAC.
   3. Central Blower Co.
   5. Jenco Fan.
   7. Or Approved Equal

B. Description: Direct- or belt-driven sidewall fans consisting of wall housing, propeller, fan shaft, bearings, motor and disconnect switch, drive assembly, and accessories.

C. Housing: Galvanized short wall housing, flush exterior with OSHA guard.

D. Propeller: Aluminum.

E. Accessories:
   1. Disconnect Switch: NEMA 1, fused type, field mounted.
   2. Wall Housing and unit sleeve: flush exterior with OSHA guard.
   3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
   4. Provide galvanized steel structural supports and attachments to anchor sleeve to wall.

2.2 MOTORS

A. Comply with requirements in Division 15 Section "Motors."

B. Provide motors with thermal overloads.

C. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware.

C. Secure wall mounted units to wall with structural supports, anchor supports to wall, provide additional bracing to prevent fan sway.
D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 15 Section "Basic Mechanical Materials and Methods."

F. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories.

G. Install ducts adjacent to power ventilators to allow service and maintenance.

3.2 FIELD QUALITY CONTROL

A. 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.

END OF SECTION 15838
SECTION 15900 – FACILITIES MANAGEMENT SYSTEM

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.

B. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.

1.2 SUMMARY

A. The general project scope to provide controls and instrumentation for the HVAC systems

1. All systems are to be an extension of the existing HACC BMS network.

2. Building level controller to be a Web Based system utilizing BACnet communications at all levels. System Level controls to be distributed DDC utilizing BACnet communication

3. Valve and Damper actuation on primary equipment shall be electronic. Valves serving equipment subject to freezing temperatures shall be spring return failsafe open.

4. Valve and damper actuation on secondary unitary equipment shall be electric. Valves serving equipment subject to freezing temperatures shall be spring return failsafe open.

5. All control dampers to be provided by the BMS contractor, with the actuators furnished, installed and wired by the BMS contractor.

6. The variable frequency drives are to be provided by BMS contractor as indicated on the drawings. The drives are to be provided with communication interface compatible with the BMS contractor system.

7. Provide web based graphical displays of all primary and secondary equipment as well as building floor plans showing equipment locations and space condition information.

B. The following is the scope of work for this contractor. With regards to the sequences of operation, the BMS contractor shall:

1. Provide Building Level DDC control system integrated to existing BMS server

1.3 BMS DESCRIPTION
A. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner’s IT staff to ensure that the FMS will perform in the owner’s environment without disruption to any of the other activities taking place on that LAN.

B. Provide open communications system. The system shall be an open architecture with the capabilities to support a multi-vendor environment. To accomplish this effectively, system shall be capable of utilizing standard protocols as follows as well as be able to integrate third-party systems via existing vendor protocols. System shall communicate via BACnet protocol according to ASHRAE standard 135. The system shall not be limited to only use open communication protocols, but also be able to integrate a wide variety of third-party devices and applications via existing vendor protocols and through the latest software standards.

C. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

1.4 QUALITY ASSURANCE

A. General
1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.

2. Under this section, the contractor shall be a recognized national manufacturer, installer and service provider of BMS.

3. No dealers, franchises or other suppliers other that factory owned branch offices of the controls manufacture shall be considered for execution of this project.

4. The contractor furnishing the work under this section shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.

1.5 WORK BY OTHERS
A. The demarcation of work and responsibilities between the contractor under this specification section and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX.

<table>
<thead>
<tr>
<th>BMS RESPONSIBILITY MATRIX</th>
<th>FURNISH</th>
<th>INSTALL</th>
<th>Low Volt. WIRING/TUBE</th>
<th>LINE POWER</th>
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<td>Automatic valves</td>
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<td>BMS</td>
<td>EC</td>
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1.6 SUBMITTALS

A. Shop Drawings, Product Data, and Samples

5. The contractor shall submit a list of all shop drawings with submittals dates within 60 days of contract award.

6. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved for Contract compliance.

7. Allow 15 working days for the review of each package by the Owner’s Representative and the Engineer in the scheduling of the total BMS work.

8. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the contractor under this section, where filing is necessary. Provide a copy of all related correspondence and permits to the Owner’s Representative.

9. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.

10. Under this section, the contractor shall correct any errors or omissions noted in the first review.

11. At a minimum, submit the following:
   a. BMS network architecture diagrams including all nodes and interconnections.
   b. Systems schematics, sequences and flow diagrams.
   c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
   d. Samples of Graphic Display screen types and associated menus.
   e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
   f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
   g. Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
   h. Details of all BMS interfaces and connections to the work of other trades.
   i. Product data sheets or marked catalog pages including part number, photo and description for all products including software.
1.7 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals

12. Three (3) copies of the Operation and Maintenance Manuals shall be
provided to the Owner's Representative upon completion of the project.
The entire Operation and Maintenance Manual shall be furnished on
Compact Disc media, and include the following for the BMS provided:
   a. Table of contents.
   b. As-built system record drawings. Computer Aided Drawings (CAD)
record drawings shall represent the as-built condition of the system
and incorporate all information supplied with the approved submittal.
   c. Manufacturers product data sheets or catalog pages for all products
including software.
   d. System Operator's manuals.
   e. Archive copy of all site-specific databases and sequences.
   f. BMS network diagrams.
   g. Interfaces to all third-party products and work by other trades.

13. The Operation and Maintenance Manual CD shall be self-contained, and
include all necessary software required to access the product data sheets.
A logically organized table of contents shall provide dynamic links to view
and print all product data sheets. Viewer software shall provide the ability
to display, zoom, and search all documents.

1.8 WARRANTY

A. Standard Material and Labor Warranty:

14. Provide a one-year labor and material warranty on the BMS.

15. If within twelve (12) months from the date of acceptance of product, upon
written notice from the owner, it is found to be defective in operation,
workmanship or materials, it shall be replaced, repaired or adjusted at the
option of the BMS Contractor at the cost of the BMS Contractor.

16. Maintain an adequate supply of materials within 100 miles of the Project
site such that replacement of key parts and labor support, including
programming. Warranty work shall be done during BMS Contractor's
normal business hours.

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

A. The Building Management System (BMS) shall use an open architecture and
fully support a multi-vendor environment. To accomplish this effectively, the
BMS shall support open communication protocol standards and integrate a wide
variety of third-party devices and applications. The system shall be designed for
use on the Internet, or intranets using off the shelf, industry standard technology
compatible with other owner provided networks.
B. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

D. Systems shall utilize wireless communication where applicable for temperature sensing and field controller communication

E. Acceptable Manufacturers
   1. Johnson Controls, Metasys  Contact Scott Schmittel  717-712-1804

2.2 BMS ARCHITECTURE

A. Automation Network
   1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels
   2. DDC Controllers shall communicate on the automation network via BACnet TCP/IP protocol over Ethernet
   3. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
   4. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

B. Control Network
   1. Network Automation Engines shall provide supervisory control over the control network and shall have the capability to simultaneously support all three (3) of the following communication protocols:
      b. LonWorks enabled devices using the FreeTopology Transceiver (FTT-10a).
      c. The Johnson Controls N2 Field Bus.
   2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
   3. DDC Application Specific Controllers shall reside on the control network.
5. A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

2.3 USER INTERFACE

1. Alarms
   a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
      ◊ Log date and time of alarm occurrence.
      ◊ Generate a “Pop-Up” window, with audible alarm, informing a user that an alarm has been received.
      ◊ Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
      ◊ Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
      ◊ Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
      ◊ Any attribute of any object in the system may be designated to report an alarm.

2. Schedules
   a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
      ◊ Weekly schedules
      ◊ Exception Schedules
      ◊ Monthly calendars.
   b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.

3. Password
   a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
   b. Each user shall have the following: a user name (24 characters minimum), a password (12 characters minimum), and access levels.
   c. The system shall allow each user to change his or her password at will.

4. Screen Manager - The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.

5. Dynamic Color Graphics
a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.

b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.

c. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.

d. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:

   ◊ All graphics shall be fully scalable
   ◊ The graphics shall support a maintained aspect ratio.
   ◊ Multiple fonts shall be supported.
   ◊ Unique background shall be assignable on a per graphic basis.
   ◊ The color of all animations and values on displays shall indicate if the status of the object attribute.

e. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device.

f. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.

   ◊ The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.

   ◊ In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.

b. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.

6. Historical trending and data collection

a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:

   ◊ Any point, physical or calculated, may be designated for trending.
   Three methods of collection shall be allowed:
      Defined time interval
      Upon a change of value

   ◊ Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.

7. Trend data viewing and analysis

a. Provide a trend viewing utility that shall have access to all database points.
b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.

c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends

d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.

e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.

f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.

g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.

2.4 BUILDING LEVEL CONTROLLER

A. BACnet Building Controller (BBC)

1. The BACnet Building Controller (BBC) shall be a fully user-programmable, supervisory controller. The (BBC) shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other BACnet building controllers.

2. Automation network – The (BBC) shall reside on the automation network and shall support a subnet of system controllers.

3. User Interface – Each (BBC) shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

   a. The web based UI software shall be imbedded in the (BBC). Systems that require a local copy of the system database on the user's personal computer are not acceptable.

   b. The (BBC) shall support a minimum of two (2) concurrent users.

   c. The web based user shall have the capability to access all system data through one (BBC).

   d. The (BBC) shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the (BBC).

4. Controller network – The (BBC) shall support the following communication protocols on the controller network:

   a. The (BBC) shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.

      ◊ A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

      ◊ The (BBC) shall support a minimum of 50 control devices.

   b. The (BBC) shall support LonWorks enabled devices using the Free Topology Transceiver FTT10.
All LonWorks controls devices shall be LonMark certified.
• The (BBC) shall support a minimum of 64 LonWorks enabled control devices.

c. The (BBC) shall support the Johnson Controls N2 Field Bus.
• The (BBC) shall support a minimum of 50 N2 control devices.
• The Bus shall conform to Electronic Industry Alliance (EIA) Standard RS-485.
• The Bus shall employ a master/slave protocol where the NAE is the master.
• The Bus shall employ a four (4) level priority system for polling frequency.
• The Bus shall be optically isolated from the (BBC).

d. Wireless applications for the Controls network shall be permitted where applicable.

2.5 DDC SYSTEM CONTROLLERS

A. Field Equipment Controller (FEC)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol.

2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.

3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable.

2.6 FIELD DEVICES

A. Input/Output Module

4. The Input/Output Module provides additional inputs and outputs for use in the FEC.

5. The IOM shall communicate with the FEC using BACnet Standard protocol SSPC-135, Clause 9.

B. Networked Thermostat

6. The Networked Thermostat shall be capable of controlling unitary HVAC system such as fan coil units, rooftop units, unit heaters, and variable volume zoning systems.

a. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine.

C. Network Sensors

8. The Network Sensors shall have the ability to monitor the following variables as required by the systems sequence of operations:
   a. Zone Temperature
   b. Zone humidity
   c. Zone setpoint


10. The Network Sensors shall include the following items:
   a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint.
   b. An LED to indicate the status of the Override feature.
   c. A button to toggle the temperature display between Fahrenheit and Celsius.
   d. A button to initiate a timed override command

D. Many-To-One Wireless Room Temperature Sensor System

1. The Many-To-One System Receiver (WRS Receiver) shall receive wireless Radio Frequency (RF) signals containing temperature data from multiple Wireless Room Temperature Sensors (WRS Sensors).

2. The WRS Receiver shall be capable of communication with WRS Sensors up to a distance of 200 Feet.

3. The WRS Sensors shall sense and report room temperatures to the WRS Receiver.
   a. The WRS sensors shall be available with
      ◦ Warmer/Cooler Set Point Adjustment
      ◦ No Set Point Adjustment
      ◦ Set Point Adjustment Scale – 55 to 85°F.
   b. The WRS sensors shall be assembled in NEMA 1 plastic housings.

2.7 INPUT DEVICES

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

2. All input device references to be understood as to be “where required to meet the intent of the sequences of operation”

B. Temperature Sensors

1. General Requirements:
a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.

b. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.

c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

<table>
<thead>
<tr>
<th>Point Type</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Room Temp</td>
<td>± .5°F.</td>
</tr>
<tr>
<td>Duct Temperature</td>
<td>± .5°F.</td>
</tr>
<tr>
<td>All Others</td>
<td>± .75°F.</td>
</tr>
</tbody>
</table>

2. Room Temperature Sensors
   a. Room sensors shall be constructed for either surface or wall box mounting.
   b. Room sensors shall have the following options when specified on the project plans:
      ◊ Setpoint reset slide switch providing a ±3 degree (adjustable) range.
      ◊ Individual heating/cooling setpoint slide switches.
      ◊ A momentary override request push button for activation of after-hours operation.
      ◊ Analog thermometer.

3. Room Temperature Sensors with Integral Display
   a. Room sensors shall be constructed for either surface or wall box mounting.
   b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
      ◊ Display room and outside air temperatures.
      ◊ Display and adjust room comfort setpoint.
      ◊ Display and adjust fan operation status.
      ◊ Timed override request push button with LED status for activation of after-hours operation.
      ◊ Display controller mode.
      ◊ Password selectable adjustment of setpoint and override modes.

4. Room Temperature and Humidity Sensors with Integral Display
   a. Room sensors shall be constructed for either surface or wall box mounting.
   b. Room sensors shall have an integral LCD display and four button keypad with the following capabilities:
      ◊ Display room and outside air temperatures.
      ◊ Display room humidity
      ◊ Display and adjust room comfort setpoint.
      ◊ Display and adjust fan operation status.
Diamond Timed override request push button with LED status for activation of after-hours operation.
Diamond Display controller mode.
Diamond Password selectable adjustment of setpoint and override modes.

5. Thermo wells
   a. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and Greenfield fitting.
   b. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
   c. Thermo wells and sensors shall be mounted in a thread-let or 1/2" NFT saddle and allow easy access to the sensor for repair or replacement.
   d. Thermo wells shall be constructed of 316 stainless steel or brass as directed by the project plans.

6. Outside Air Sensors
   a. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
   b. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
   c. Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.

7. Duct Mount Sensors
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
   b. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
   c. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

8. Averaging Sensors
   a. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
   b. For plenum applications, such as mixed air temperature measurements, a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
   c. Capillary supports at the sides of the duct shall be provided to support the sensing string.


C. Humidity Sensors
10. The sensor shall be a solid-state type, relative humidity sensor of the Bulk Polymer Design. The sensor element shall resist service contamination.

11. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.

12. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 85 Deg F adjustable unless specified elsewhere.

13. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealitite fittings and stainless steel bushings.

14. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.

15. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.


B. Differential Pressure Transmitters

1. General Air and Water Pressure Transmitter Requirements:
   a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
   b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
   c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
   d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

2. Low Differential Water Pressure Applications (0" - 20" w.c.)
   a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
   b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
      ◊ .01-20" w.c. input differential pressure range.
      ◊ 4-20 mA output.
      ◊ Maintain accuracy up to 20 to 1 ratio turndown.
      ◊ Reference Accuracy: +0.2% of full span.

1. Building Differential Air Pressure Applications (-1" to +1" w.c.)
a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
   ◊ -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
   ◊ 4-20 mA output.
   ◊ Maintain accuracy up to 20 to 1 ratio turndown.
   ◊ Reference Accuracy: +0.2% of full span.
c. Acceptable Manufacturers: Johnson Controls and Setra.

2. Low Differential Air Pressure Applications (0" to 5" w.c.)
   a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
   b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
      ◊ (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges.
         (Select range appropriate for system application.)
      ◊ 4-20 mA output.
      ◊ Maintain accuracy up to 20 to 1 ratio turndown.
      ◊ Reference Accuracy: +0.2% of full span.
   c. Acceptable Manufacturers: Johnson Controls and Setra.

C. Smoke Detectors
   1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 16 for installation under Division 15. All wiring for air duct detectors shall be provided under Division 16, Fire Alarm System.

D. Status and Safety Switches
   1. General Requirements
      a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.
   2. Current Sensing Switches
      a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
      b. Acceptable manufacturers: Veris Industries
   3. Air Filter Status Switches
a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
c. Acceptable manufacturers: Johnson Controls, Cleveland Controls

4. Air Flow Switches
   a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
   b. Acceptable manufacturers: Johnson Controls, Cleveland Controls

5. Air Pressure Safety Switches
   a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
   b. Acceptable manufacturers: Johnson Controls, Cleveland Controls

6. Water Flow Switches
   a. Water flow switches shall be equal to the Johnson Controls P74.

7. Low Temperature Limit Switches
   a. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
   b. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
   c. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
   d. The low temperature limit switch shall be equal to Johnson Controls A70.

2.6 OUTPUT DEVICES

E. Actuators

1. General Requirements
   a. Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque. All damper and valve actuators that control in more than 2 positions (open/closed) shall be fully modulating
   b. Damper and valve actuators shall be electronic as specified in the System Description section.

2. All output device references to be understood as to be “where required to meet the intent of the sequences of operation”

3. Electronic Damper Actuators
   a. Electronic damper actuators shall be direct shaft mount.
b. Modulating and two-position actuators shall be provided as required by the sequence of operations. All actuators shall have external adjustable stops to limit the travel in either direction, and a gear release to allow manual positioning.

c. Acceptable manufacturers: Johnson Controls, Belimo.

4. Electronic Valve Actuators
   a. Electronic valve actuators shall be manufactured by the valve manufacturer.
   b. Modulating and two-position actuators shall be provided as required by the sequence of operations.
   c. Acceptable manufacturers: Johnson Controls, Valve Solutions

F. Control Dampers
   1. Under this section the contractor shall furnish all automatic dampers. All automatic dampers shall be sized as indicated on the Drawings.
   2. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.
   3. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
   4. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60”. Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomeric seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4” w.g. static pressure when tested in accordance with AMCA Std. 500.
   5. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g. Acceptable manufacturers are Johnson Controls D-7250 D-1250 or D-1300, Ruskin CD50, and Vent Products 5650.
   6. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below. Acceptable manufacturers are: Johnson Controls D-1600, Ruskin CD36, and Vent Products 5800.

G. Control Relays
   1. Control Pilot Relays
      a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
      b. Mounting Bases shall be snap-mount.
      c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
d. Contacts shall be rated for 10 amps at 120VAC.
e. Relays shall have an integral indicator light and check button.
f. Acceptable manufacturers: Johnson Controls, Lectro

H. Control Valves

1. All automatic control valves shall be fully proportioning and provide near linear heat transfer control. The valves shall be quiet in operation and fail-safe open, closed, or in their last position. All valves shall operate in sequence with another valve when required by the sequence of operations. All control valves shall be sized by the control manufacturer, and shall be guaranteed to meet the heating and cooling loads, as specified. All control valves shall be suitable for the system flow conditions and close against the differential pressures involved. Body pressure rating and connection type (sweat, screwed, or flanged) shall conform to the pipe schedule elsewhere in this Specification.

2. Ball valves shall be used for hot and chilled water applications, water terminal reheat coils, radiant panels, unit heaters, package air conditioning units, and fan coil units except those described hereinafter.

3. Acceptable manufacturers: Johnson Controls

PART 3 - EXECUTION

3.1 BMS SPECIFIC REQUIREMENTS

A. Graphic Displays

1. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list.

2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.

B. Actuation / Control Type

3. Primary Equipment

a. Controls shall be provided by equipment manufacturer as specified herein.

b. All damper and valve actuation shall be electric.

4. Air Handling Equipment

a. All air handlers shall be controlled with a HVAC-DDC Controller

b. All damper and valve actuation shall be electric.

3.2 INSTALLATION PRACTICES

A. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the contractor under this section unless specifically shown
on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.

2. Class 2 Wiring
   a. Class 2 wiring for sensors, actuators and communication buses shall be in conduit where exposed or inaccessible.
   b. Class 2 wiring for sensors, actuators and communication buses shall be run using "open cable" wiring practices where concealed yet accessible. Open cable to be plenum rated where required.

3. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

B. BMS Line Voltage Power Source
   1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 16.
   2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.

C. HVAC Input Devices – General
   3. All Input devices shall be installed per the manufacturer recommendation
   4. Locate components of the BMS in accessible local control panels wherever possible.
   5. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
   7. Outside Air Sensors
      a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
      b. Sensors shall be installed with a rain proof, perforated cover.
   8. Water Differential Pressure Sensors
      a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
      b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
      c. The transmitters shall be installed in an accessible location wherever possible.
   7. Building Differential Air Pressure Applications (-1" to +1" w.c.):
      c. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
      d. The interior tip shall be inconspicuous and located as shown on the drawings.
   8. Duct Temperature Sensors:
a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.

b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.

c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.

9. Space Sensors:
   a. Shall be mounted per ADA requirements.
   b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.

10. Low Temperature Limit Switches:
    a. Install on the discharge side of the first water or steam coil in the air stream.
    b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
    c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

11. Air Differential Pressure Status Switches:
    a. Install with static pressure tips, tubing, fittings, and air filter.

12. Water Differential Pressure Status Switches:
    a. Install with shut off valves for isolation.

D. HVAC Output Devices

13. All output devices shall be installed per the manufacturer's recommendation. The contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.

14. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.

15. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.

16. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.

17. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a RTU control panel), or to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems.
3.3 TRAINING

A. Under this section, the contractor shall provide the following training services:
   1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

3.4 PROGRAMMING

A. Provide sufficient internal memory for the specified control sequences and trend logging. There shall be a minimum of 25% of available memory free for future use.

B. Point Naming: System point names shall be modular in design, allowing easy operator interface without the use of a written point index.

C. Software Programming
   1. Provide programming for the system as per specifications and adhere to the strategy algorithms provided. All other system programming necessary for the operation of the system but not specified in this document shall also be provided by the BAS vendor. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequence of operations.

D. Operators' Interface
   1. The controls manufacturer shall provide all the labor necessary to install, initialize, start-up, and trouble-shoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface data base, and any third party software installation and integration required for successful operation of the operator interface.

3.5 CLEANING

A. The Contractor shall clean up all debris resulting from his or her activities daily. The Contractor shall remove all cartons, containers, crates, etc. under his control as soon as their contents have been removed. Waste shall be collected and placed in a location designated.

B. At the completion of work in any area, the Contractor shall clean all of his/her work, equipment, etc., making it free from dust, dirt and debris, etc.

C. At the completion of work, all equipment furnished under this Section shall be checked for paint damage, and any factory finished paint that has been damaged shall be repaired to match the adjacent areas. Any metal cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.
3.6 FIELD QUALITY CONTROL

A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning, and integrated system program commissioning. Document all commissioning information on commissioning data sheets that shall be submitted for record. Commissioning work that requires the shutdown of various systems or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the Department and construction manager to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the Department and construction manager are present throughout the commissioning procedure.

1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:

2. Sensor accuracy as confirmed at a single point by a calibrated test instrument.


4. Verify analog limit and binary alarm reporting.

5. Point value reporting.


7. Actuator ranges.

8. Fail safe operation on loss of control signal, electric power, network communications.

9. Under this section, the contractor shall submit for record, as needed, all calibration certificates for testing instruments used in the commissioning process.

10. Temperature: ¼ deg F or 1/2% full scale, whichever is less.

11. Pressure: High Pressure (psi): ½ psi or 1/2% full scale, whichever is less.

12. Low Pressure: 1/2% of full scale

13. Humidity: 2% RH

14. Electrical: 1/4% full scale

B. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BAS program shall be put online and commissioned. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy. Any discrepancies between the specification and the actual performance will be immediately rectified and re-commissioned.

C. After all BAS programs have been commissioned; the BAS vendor shall verify the overall system performance as specified. Tests shall include, but not be limited to:

1. Data communication, both normal and failure modes.
2. Impact of component failures on system performance and system operation.
3. Season changeover.
4. Global application programs and point sharing.
5. System backup and reloading.
7. Diagnostic functions.
8. Power failure routines.
9. All commissioning documents listed below shall be submitted for record.
   a. Test data sheets, listing all programmed software points
   b. Sequence of operations verification sheets
   c. Calibration sheets for test equipment, as needed
10. After the above tests are complete and the system is demonstrated to be functioning as specified, the system shall be turned over to the Department.

3.7 TESTING AND DEMONSTRATION

A. Under this section, the contractor shall perform a complete test of the operator interface. Test duration shall be a minimum of 24 hours on-site. Tests shall be made in the presence of the Department or Department's representative and the Professional.

B. A complete demonstration and readout of the capabilities of the monitoring and control system shall be performed. The BAS vendor shall dedicate a minimum of 24 hours on-site with the Department and his representatives for a complete functional demonstration and training of all the system requirements, including operation, adjustment, and maintenance. The training sessions shall be in six 4-hour sessions. This demonstration constitutes a joint acceptance inspection, and permits acceptance of the delivered system for on-line operation. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 15900
SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, adjusting, and balancing of air systems.
2. Testing, adjusting, and balancing of hydronic systems.
3. Measurement of final operating condition of HVAC systems.
4. Sound measurement of equipment operating conditions.
5. Vibration measurement of equipment operating conditions.

B. Related Sections:

1. Division 15 section for Air Cooled Condensing Units: Product requirements for refrigerant piping connections to air handling units.
2. Division 15 section for Rooftop Air Handling Units
3. Division 15 section for Metal Duct and Grilles: Product requirements for flexible duct connections for placement by this section.

1.2 REFERENCES

A. Associated Air Balance Council:


B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:


1.3 SUBMITTALS

A. Division 1 section for Submittal Procedures: Submittal procedures.

B. Prior to commencing Work, submit proof of latest calibration date of each instrument.

C. Test Reports: Indicate data on AABC MN-1 National Standards for Total System Balance forms.

D. Field Reports: Provide field reports on a daily basis indicating results of testing and balancing performed that day. Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
E. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty.

F. Submit draft copies of report for review prior to final acceptance of Project.

G. Furnish reports in soft cover, letter size, 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

1.4 CLOSEOUT SUBMITTALS

A. Division 1 section for Execution Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of flow measuring stations balancing valves and rough setting.

C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with AABC MN-1 National Standards for Field Measurement and Instrumentation, Total System.

B. Maintain one copy of each document on site.

C. Prior to commencing Work, calibrate each instrument to be used. Upon completing Work, recalibrate each instrument to assure reliability.

1.6 QUALIFICATIONS

A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum three years documented experience certified by AABC.

1.7 SEQUENCING

A. Division 1 section for Summary: Work sequence.

B. Sequence balancing between completion of systems tested and Date of Substantial Completion.
PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify systems are complete and operable before commencing work. Verify the following:

1. Systems are started and operating in safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place or in normal position.
15. Service and balancing valves are open.
16. Record all Voltage and Amp readings on all moving equipment.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations.

B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic and Steam Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Division 1 section for Execution Requirements: Testing, adjusting, and balancing.

B. Verify recorded data represents actual measured or observed conditions.
C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

E. Report defects and deficiencies noted during performance of services, preventing system balance.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

H. Check and adjust systems approximately three additional times over the initial 12-month operating period after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.

F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.

L. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.

3.6 WATER SYSTEM PROCEDURE

A. Adjust water systems, after air balancing, to obtain design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.

C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.

3.7 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:

1. HVAC Pumps.
2. Air Cooled Refrigerant Condensers.
3. Air Handling Units.
4. Exhaust Fans.
5. Air Terminal Units.
6. Air Inlets and Outlets.

B. Report Forms

1. Title Page:
   a. Name of Testing, Adjusting, and Balancing Agency
   b. Address of Testing, Adjusting, and Balancing Agency
   c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
d. Project name
e. Project location
f. Project Engineer
g. Project Contractor
h. Project altitude
i. Report date

2. Summary Comments:
   a. Design versus final performance
   b. Notable characteristics of system
c. Description of systems operation sequence
d. Summary of outdoor and exhaust flows to indicate building pressurization
e. Nomenclature used throughout report
f. Test conditions

3. Instrument List:
   a. Instrument
   b. Manufacturer
c. Model number
d. Serial number
e. Range
f. Calibration date

4. Electric Motors:
   a. Manufacturer
   b. Model/Frame
c. HP/BHP and KW
d. Phase, voltage, amperage; nameplate, actual, no load
e. RPM
f. Service factor
g. Starter size, rating, heater elements
h. Sheave Make/Size/Bore

5. V-Belt Drive:
   a. Identification/location
   b. Required driven RPM
c. Driven sheave, diameter and RPM
d. Belt, size and quantity
e. Motor sheave diameter and RPM
f. Center to center distance, maximum, minimum, and actual.

6. Pump Data:
   a. Identification/number
   b. Manufacturer
c. Size/model
d. Impeller  
e. Service  
f. Design flow rate, pressure drop, BHP and KW  
g. Actual flow rate, pressure drop, BHP and KW  
h. Discharge pressure  
i. Suction pressure  
j. Total operating head pressure  
k. Shut off, discharge and suction pressures  
l. Shut off, total head pressure

7. Air Cooled Condenser:
   a. Identification/number  
   b. Location  
   c. Manufacturer  
   d. Model number  
   e. Serial number  
   f. Entering DB air temperature, design and actual  
   g. Leaving DB air temperature, design and actual  
   h. Number of compressors.

8. Cooling Coil Data:
   a. Identification/number  
   b. Location  
   c. Service  
   d. Manufacturer  
   e. Air flow, design and actual  
   f. Entering air DB temperature, design and actual  
   g. Entering air WB temperature, design and actual  
   h. Leaving air DB temperature, design and actual  
   i. Leaving air WB temperature, design and actual  
   j. Saturated suction temperature, design and actual  
   k. Air pressure drop, design and actual.

9. Heating Coil Data:
   a. Identification/number  
   b. Location  
   c. Service  
   d. Manufacturer  
   e. Air flow, design and actual  
   f. Water flow, design and actual  
   g. Water pressure drop, design and actual  
   h. Entering water temperature, design and actual  
   i. Leaving water temperature, design and actual  
   j. Entering air temperature, design and actual  
   k. Leaving air temperature, design and actual  
   l. Air pressure drop, design and actual.

10. Air Moving Equipment:
a. Location
b. Manufacturer
c. Model number
d. Serial number
e. Arrangement/Class/Discharge
f. Air flow, specified and actual
g. Return air flow, specified and actual
h. Outside air flow, specified and actual
i. Total static pressure (total external), specified and actual
j. Inlet pressure
k. Discharge pressure
l. Sheave Make/Size/Bore
m. Number of Belts/Make/Size
n. Fan RPM

11. Return Air/Outside Air Data:

a. Identification/location
b. Design air flow
c. Actual air flow
d. Design return air flow
e. Actual return air flow
f. Design outside air flow
g. Actual outside air flow
h. Return air temperature
i. Outside air temperature
j. Required mixed air temperature
k. Actual mixed air temperature
l. Design outside/return air ratio
m. Actual outside/return air ratio

12. Exhaust Fan Data:

a. Location
b. Manufacturer
c. Model number
d. Serial number
e. Air flow, specified and actual
f. Total static pressure (total external), specified and actual
g. Inlet pressure
h. Discharge pressure
i. Sheave Make/Size/Bore
j. Number of Belts/Make/Size
k. Fan RPM

13. Duct Traverse:

a. System zone/branch
b. Duct size
c. Area
d. Design velocity
14. Duct Leak Test:
   a. Description of ductwork under test
   b. Duct design operating pressure
   c. Duct design test static pressure
   d. Duct capacity, air flow
   e. Maximum allowable leakage duct capacity times leak factor
   f. Test apparatus
      1) Blower
      2) Orifice, tube size
      3) Orifice size
      4) Calibrated
   g. Test static pressure
   h. Test orifice differential pressure
   i. Leakage

15. Flow Measuring Station:
   a. Identification/number
   b. Location
   c. Size
   d. Manufacturer
   e. Model number
   f. Serial number
   g. Design Flow rate
   h. Design pressure drop
   i. Actual/final pressure drop
   j. Actual/final flow rate
   k. Station calibrated setting

16. Air Distribution Test Sheet:
   a. Air terminal number
   b. Room number/location
   c. Terminal type
   d. Terminal size
   e. Area factor
   f. Design velocity
   g. Design air flow
   h. Test (final) velocity
   i. Test (final) air flow
   j. Percent of design air flow
17. Sound Level Report:
   a. Location
   b. Octave bands - equipment off
   c. Octave bands - equipment on
   d. RC level - equipment on

18. Vibration Test:
   a. Location of points:
      1) Fan bearing, drive end
      2) Fan bearing, opposite end
      3) Motor bearing, center (when applicable)
      4) Motor bearing, drive end
      5) Motor bearing, opposite end
      6) Casing (bottom or top)
      7) Casing (side)
      8) Duct after flexible connection (discharge)
      9) Duct after flexible connection (suction)
   b. Test readings:
      1) Horizontal, velocity and displacement
      2) Vertical, velocity and displacement
      3) Axial, velocity and displacement
   c. Normally acceptable readings, velocity and acceleration
   d. Unusual conditions at time of test
   e. Vibration source (when non-complying).

END OF SECTION 15950
SECTION 16050 - BASIC ELECTRICAL MATERIALS AND METHODS

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.

B. Related Sections include the following:

1. Division 16130 Raceway & Boxes.

1.2 SUMMARY

A. This Section includes the following:

1. Electrical equipment coordination and installation.
2. Common electrical installation requirements.
3. Fire-stop Systems

1.3 FIRE-STOP SYSTEM PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration fire-stop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration fire-stop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration fire-stop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration fire-stop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
   a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistance-rated shaft enclosures.

C. For through-penetration fire-stop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration fire-stop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide fire-stop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration fire-stop systems not requiring removal of insulation.

D. For through-penetration fire-stop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 SUBMITTALS

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

B. Shop Drawings: For each through-penetration fire-stop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include fire-stop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration fire-stop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration fire-stop condition, submit illustration, with modifications marked, approved by through-penetration fire-stop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Fire-stop System Schedule: Indicate locations of each through-penetration fire-stop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration fire-stop systems for each location identified by fire-stop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.
E. Product Certificates: For through-penetration fire-stop system products, signed by product manufacturer.

F. Product Test Reports: From a qualified testing agency indicating through-penetration fire stop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

B. Installer Qualifications: A firm experienced in installing through-penetration fire-stop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements.

C. Installation Responsibility: Assign installation of fire-stop systems and fire-resistive joint systems in Project to a single qualified installer.

D. Source Limitations: Obtain through-penetration fire-stop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

E. Fire-Test-Response Characteristics: Provide through-penetration fire-stop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Fire-stopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-stop systems acceptable to authorities having jurisdiction.

2. Through-penetration fire-stop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

   a. Through-penetration fire-stop system products bear classification marking of qualified testing and inspecting agency.

   b. Through-penetration fire-stop systems correspond to those indicated by reference to through-penetration fire-stop system designations listed by the following:

      1) UL in its "Fire Resistance Directory."
      2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
      3) ITS in its "Directory of Listed Products."

1.6 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

D. Coordinate construction of openings and penetrating items to ensure that through-penetration fire-stop systems are installed according to specified requirements.

E. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire-stop systems.

F. Do not cover up through-penetration fire-stop system installations that will become concealed behind other construction until each installation has been examined by building inspector, if required by authorities having jurisdiction.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration fire-stop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration fire-stop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration fire-stop systems when ambient or substrate temperatures are outside limits permitted by through-penetration fire-stop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration fire-stop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration fire-stop systems that may be incorporated into the Work include, but are not limited to, those systems indicated that are produced by one of the following manufacturers:

1. Nelson Fire-stop Products.
2. Specified Technologies Inc.
3. 3M; Fire Protection Products Division.

2.2 FIRE-STOPPING, GENERAL

A. Compatibility: Provide through-penetration fire-stop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration fire-stop systems, under conditions of service and application, as demonstrated by through-penetration fire-stop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration fire-stop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration fire-stop system manufacturer and approved by qualified testing and inspecting agency for fire-stop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
   a. Slag-/rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.

2. Temporary forming materials.
5. Steel sleeves.

2.3 FILL MATERIALS

A. General: Provide through-penetration fire-stop systems containing the types of fill materials indicated in the Through-Penetration Fire-stop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Fire-stop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an
intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Fire-stop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated fire-stop system limits use to nonsag grade for both opening conditions.

2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.


2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration fire-stop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection
of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1-2000 Standard Practices for Good Workmanship in Electrical Construction for all work performed under this contract.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items. Refer to electrical drawings for specific mounting heights. Where mounting heights not indicated on drawings contractor shall refer to the manufacturers recommendations for mounting and shall notify the engineer/architect of findings prior to installation.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 FIRE-STOPPING

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Preparation

1. Surface Cleaning: Clean out openings immediately before installing through-penetration fire-stop systems to comply with fire-stop system manufacturer’s written instructions and with the following requirements:

   a. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration fire-stop systems.

   b. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration fire-stop systems. Remove loose particles remaining from cleaning operation.
c. Remove laitance and form-release agents from concrete.

2. Priming: Prime substrates where recommended in writing by through-penetration fire-stop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3. Masking Tape: Use masking tape to prevent through-penetration fire-stop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-stop system materials. Remove tape as soon as possible without disturbing fire-stop system's seal with substrates.

C. Through-Penetration Fire-Stop System Installation

1. General: Install through-penetration fire-stop systems to comply with Part 1 "Performance Requirements" Article and with fire-stop system manufacturer's written installation instructions and published drawings for products and applications indicated.

2. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

   a. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-stop systems.

3. Install fill materials for fire-stop systems by proven techniques to produce the following results:

   a. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

   b. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

   c. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

D. Identification

1. Identify through-penetration fire-stop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the fire-stop systems so that labels will be visible to anyone seeking to remove penetrating items or fire-stop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

b. Contractor's name, address, and phone number.

c. Through-penetration fire-stop system designation of applicable testing and inspecting agency.

d. Date of installation.

e. Through-penetration fire-stop system manufacturer's name.

f. Installer's name.

E. Cleaning And Protecting

1. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration fire-stop system manufacturers and that do not damage materials in which openings occur.

2. Provide final protection and maintain conditions during and after installation that ensure that through-penetration fire-stop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration fire-stop systems immediately and install new materials to produce systems complying with specified requirements.

F. Through-Penetration Fire-Stop System Schedule

1. Where UL-classified systems are indicated, they refer to alpha-alphanumeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

2. Fire-stop Systems for Metallic Pipes, Conduit, or Tubing FS-1:


b. Type of Fill Materials: One or more of the following:

   1) Latex sealant.
   2) Silicone sealant.
   3) Intumescent putty.
   4) Mortar.

3. Fire-stop Systems for Electrical Cables FS-2:


b. Type of Fill Materials: One or more of the following:
1) Latex sealant.
2) Silicone sealant
3) Intumescent putty.
4) Silicone foam.
5) Pillows/bags.

4. Fire-stop Systems for Miscellaneous Electrical Penetrants FS-3:
   b. Type of Fill Materials: One or more of the following:
      1) Latex sealant.
      2) Intumescent putty.
      3) Mortar.

5. Fire-stop Systems for Miscellaneous Mechanical Penetrants FS-4:
   b. Type of Fill Materials: One or both of the following:
      1) Latex sealant.
      2) Mortar.

3.3 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations and associated fire-stopping for damage and faulty work.

B. Where deficiencies are found, repair or replace through-penetration fire-stop systems so they comply with requirements.

END OF SECTION 16050
SECTION 16060 - GROUNDING AND BONDING

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 methods and materials for grounding systems and equipment.

1.3 SUBMITTALS

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

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:

1. Ground conductors.

C. Qualification Data: For testing agency and testing agency’s field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells and grounding connections for separately derived systems based on NETA Acceptance Testing Standards (ATS).

   a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.

   b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing
laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency’s Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 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:

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

Bolted Connectors: Heavy duty irreversible compression terminal with inspection hole and minimum two (2) bolt holes for #2 AWG through 500 KCMIL

2. Structural Steel Connector: Designed for welding to structural steel columns.
3. Flexible Connections: Flexible copper braided jumper made of flexible, tinned, pure copper braid, with unplated seamless, pure copper ferrules formed into a rectangular shape on each end. Length as required.
4. Conduit and Tube Connect clamps: Copper, adjustable clamp type for bonding rigid conduit and tube systems.
5. Rebar: Irreversible compression ground tap suitable for direct burial in earth or concrete, pre-filled with PENETROX compound and strip sealed.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions. Underground connections not encased in concrete shall be exothermic weld type.

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 irreversible compression two (2) bolt connectors.
   2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
   3. Connections to Ground Rods at Test Wells: Bolted connectors.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. And as noted on the drawings.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
4. Provide Bonding straps at new valves, actuators, and pipe joints.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

B. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without
chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

C. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 750 kVA and Less: 5 ohms.

D. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 16060
SECTION 16072 - ELECTRICAL SUPPORTS

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. Hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.
C. IMC: Intermediate metal conduit.
E. OSHPD: Office of Statewide Health Planning and Development.
F. RMC: Rigid metal conduit.
H. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support component used.

1. Annotate to indicate application of each product submitted and compliance with requirements.

B. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
C. Welding certificates.

D. Qualification Data: For testing agency.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of Six (6) times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Manufacturers:

   a. Cooper B-Line; a division of Cooper Industries.
   b. ERICO International Corporation.
   c. Allied Support Systems; Power-Strut Unit.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.

2. Finishes:

   a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
   b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
   c. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-3.

3. Channel Dimensions: Selected for structural loading.
C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

   a. Manufacturers:

      1) Cooper B-Line; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc
      3) Hilti, Inc.
      4) ITW Construction Products.
      5) MKT Fastening, LLC.
      6) Powers Fasteners.

2. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.


5. Toggle Bolts: All-steel springhead type.


2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 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 and RMC as scheduled in NECA 1, where 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 trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
   2. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
   1. To Wood: Fasten with lag screws or through bolts. Support structure shall be self supporting through floor supports.
   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 Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
5. To Light Steel: Sheet metal screws.
6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION 16072
SECTION 16075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Identification for raceway.
   2. Identification for conductors and communication and control cable.
   3. Warning labels and signs.
   4. Instruction signs.
   5. Equipment identification labels.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE


B. Comply with NFPA 70.


1.5 COORDINATION


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 RACEWAY 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. Color for Printed Legend:
   1. Power Circuits: Black letters on an orange field.
   2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.2 CONDUCTOR AND COMMUNICATION AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 2 inches wide.

B. Marker Tapes: Provide Brady tis-2200 or equal for all branch circuits and control wiring. Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
   1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
2.3 WARNING LABELS AND SIGNS


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. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. 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."

2.4 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
   1. Engraved legend with black letters on white face.
   2. Punched or drilled for mechanical fasteners.
   3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

B. 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.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   2. Tensile Strength: 50 lb, minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.

B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
   1. Mechanical and Electrical Supervisory System: Green and blue.
   2. Telecommunication System: Green and yellow.
   3. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 12 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape and aluminum wraparound marker labels. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification:
   1. Provide Brady TLS-2200 or equal cn each end of conductor. It shall indicate panel and circuit numbers.
   2. Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

E. Conductors to Be Extended in the Future: Attach write-on tags and marker tape to conductors and list source and circuit number.

   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply baked-enamel warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
   a. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
3. Equipment which possesses an arc flash hazard or risk. Comply with NEC requirements for equipment labeling. Warning label must be clearly displayed on the front cover of all panelboards and other arc flash hazard equipment.

H. Instruction Signs:

1. Operating Instructions: 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.
2. Emergency Operating Instructions: 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.

I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and 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: 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 2 lines of text are required, use labels 2 inches high.
   b. Outdoor Equipment: Stenciled legend 4 inches high.
c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:
   a. Panelboards, electrical cabinets, and enclosures.
   b. Emergency system boxes and enclosures.
   c. Disconnect switches.
   d. Enclosed circuit breakers.
   e. Motor starters.
   f. Push-button stations.
   g. Power transfer equipment.
   h. Contactors.
   i. Remote-controlled switches, dimmer modules, and control devices.
   j. Monitoring and control equipment.
   k. Wiring devices, Terminals, racks, and patch panels associated with voice and data communication systems including PA/Intercom systems and auditorium/cafeterium sound systems.

3.2 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 nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
2. Colors for 208/120-V Circuits:
a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.
d. Neutral: White
e. Ground: Green

3. Colors for 480/277-V Circuits:
b. Phase B: Orange.
c. Phase C: Yellow.
d. Neutral: Gray
e. Ground: Green

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

END OF SECTION 16075
SECTION 16130 - RACEWAYS AND BOXES

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 raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

E. Related Sections include the following:
   1. Division 16 Section 16050 for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
   2. Division 16 Section "Electrical Supports" for bracing of raceways, boxes, enclosures, and cabinets.
   3. Division 16 Section 16120 "Electrical Conductors and Cables".

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid tight flexible metal conduit.

F. NBR: Acrylonitrile-butadiene rubber.

G. RMC: Rigid Metallic Conduit.

H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
   1. Surface Metal Raceway.

B. Shop Drawings: Show fabrication and installation details of components for raceways, fittings, boxes, enclosures, and cabinets.
1. Surface Metal Raceway:

   a. Submit product data including manufacturer brochures and specific product data sheets identifying each component to be used with arrows and circles.

   b. Submit Manufacturer certified coordination/installation drawings of complete engineered system for each application indicated on drawings. Drawings shall indicate length(s), identify all components, wiring diagrams, wiring device and communications device types and dimensioned locations, and complete material lists.

   c. Include installation details and cutting and patching details and methods.

   d. Submit sample of material of specified color and device plates.

C. Coordination Drawings: Reflected ceiling plans and details drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Details for lighting fixtures including details for all wall penetrations and sleeves installations.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 and NECA installation standards.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with existing light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate mounting heights, orientation and locations of surface mounted raceway mounted above counters, benches, backsplashes, whiteboards, tackstrips, chalkboards, etc.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Protect conduit and raceways from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co. /Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Wheatland Tube Co.

B. Rigid Galvanized Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.


E. Plastic-Coated IMC and Fittings: NEMA RN 1.

F. EMT and Fittings: ANSI C80.3.

1. Fittings: Steel set-screw type.

G. FMC: Zinc-coated flexible steel conduit.

H. LFMC: Flexible steel conduit with PVC jacket.

I. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
10. Spring City Electrical Manufacturing Co.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1 (unless otherwise noted on drawings), with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.4 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.

2.5 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
4. Boxes and Enclosures outdoors: NEMA 250, Type 3R.

B. Indoors Pool Area and Pump Room:

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Indoors Other Areas:

1. Exposed where subject to physical damage including boiler rooms and/or mechanical/electrical rooms: RMC
2. Exposed where not subject to physical damage including all crawl spaces: EMT.
3. Concealed: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
5. Damp or Wet Locations: Rigid steel conduit.
6. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
a. Damp or Wet Locations: NEMA 250, Type 3R.

D. Minimum Raceway Size: 3/4-inch trade size (DN 21).

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

F. Use of Aluminum Conduits, Sleeves, Fittings or Hardware is not permitted.

3.2 INSTALLATION

A. 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.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Electrical Supports".

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal conduit and EMT within finished walls, ceilings, and floors where possible. In public areas of the school the required, minimum size steel surface raceway is rigid galvanized steel conduit in the pool area and electrical metallic tubing in other public areas. Both shall be painted to match surface the conduits are installed on.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

I. Join raceways with fittings designed and approved for that purpose and make joints tight.
1. Use insulating bushings to protect conductors.

J. Tighten set screws of threadless fittings with suitable tools.

K. Terminations:
   1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
   2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

L. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 24 inches of slack at each end of pull wire and secure.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

N. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

O. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

P. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 INSTALLATION-SURFACE MOUNTED RACEWAY

A. Prior to and during installation, refer to system layout or approval drawings containing all elements of the system. Installer shall comply with detailed manufacturer’s instruction sheets, which accompany systems components, as well as complete system instruction sheets, whichever is applicable.

B. All raceway systems shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, also in accordance with manufacturer’s installation instructions.
C. All metal raceway shall be electrically continuous and bonded in accordance with the National Electrical Code.

D. Raceway shall be securely supported at intervals not exceeding 10 feet or in accordance with manufacturer’s recommendations and installation instructions.

E. All raceway systems shall be installed complete, including insulating bushings and inserts where required by manufacturer’s installation instructions. All unused raceway openings shall be closed.

F. Provide labels for each receptacle, outlet box, and junction box indicating panel and circuit number in accordance with specification section 16075, “Electrical Identification”.

G. Do not install surface metal raceways overtop any existing architectural or educational material, cabinets, millwork, or finish including whiteboards, blackboards, tack strips, and bulletin boards, etc.

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 16130
SECTION 16140 - WIRING DEVICES

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. Snap switches
   2. Wall-switch.

B. Related Sections include the following:

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
D. RFI: Radio-frequency interference.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
C. Field quality-control test reports.
D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A, with ground screw, back and side wired:

1. Products: Heavy Duty Grade. Subject to compliance with requirements, provide one of the following:

   a. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
   b. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
   c. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), PS20AC4 (four way).


2.3 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. All areas use: Stainless Steel
3. Material for Damp Locations: Stainless Steel
2.4 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.
   1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NEC
c 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with rout ers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Instal device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with 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 just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multitarg wall plates.

G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Black filled laminate lettering on face of plate, and durable wire markers or tags inside outlet boxes. Comply also with requirements outlined in 16075 "Identification."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
B. Tests for Switches:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. Using the test plug, verify that the device and its outlet box are securely mounted.
5. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 16140
SECTION 16410 - 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.
B. NO: Normally open.
C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, 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.
5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.
D. 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.

E. Manufacturer's field service report.

F. Operation and Maintenance Data: For enclosed switches to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches.
2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a full member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. 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.

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 NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no less than one week in advance of proposed interruption of electric service.
2. Indicate method of providing temporary electric service.
3. Do not proceed with interruption of electric service without Owner's written permission.
4. Comply with NFPA 70E.

1.7 COORDINATION

A. Coordinate layout and installation of switches and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.8 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Fuse Pullers: Two for each size and type.

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:

1. Square D; a brand of Schneider Electric is the basis for design.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Type HD, Heavy Duty, Single Throw, 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.

2.2 NONFUSIBLE 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:

1. Square D: a brand of Schneider Electric is the basis for design.
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

B. Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, 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. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 ENCLOSURES

A. Enclosed Switches: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Pool Area and Pump Room: NEMA 250, Type 4X stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 3R.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches 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 with tops at uniform height unless otherwise indicated.

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in fusible devices.

D. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 16 Section "Electrical Identification."

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. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. 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.

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 enclosed switch and circuit breaker. Remove front
panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. 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.

D. Enclosed switches will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches 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 16410
SECTION 16420 - ENCLOSED CONTROLLERS

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. Section includes the following enclosed controllers rated 600 V and less:

   1. Full-voltage manual.
   2. Full-voltage magnetic.

B. Related Section:

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer’s technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:
   
a. Each installed unit's type and details.
b. Factory-installed devices.
c. Nameplate legends.
d. Short-circuit current rating of integrated unit.
e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.

2. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed controllers, 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.

E. Field quality-control reports.

F. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Routine maintenance requirements for enclosed controllers and installed components.
2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
3. Manufacturer's written instructions for setting field-adjustable overload relays.
4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

G. 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.
H. 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 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 enclosed controllers according to IEEE 344.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of electrical systems.
   2. Indicate method of providing temporary utilities.
   3. Do not proceed with interruption of electrical systems without Owner's written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panes.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

1.10 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. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of 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.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Square D; a brand of Schneider Electric.
   b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   d. Siemens Energy & Automation, Inc.

2. Configuration: Nonreversing.
3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button, melting alloy type.
4. Surface mounting.
5. Red pilot light.

C. Magnetic Controllers: Full voltage, across the line, electrically held.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Square D; a brand of Schneider Electric.
   b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   d. Siemens Energy & Automation, Inc.

2. Configuration: Nonreversing.
3. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.
   a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
   a. CPT Spare Capacity: 100 VA.

6. Solid-State Overload Relay: Solid-State Overload Relays shall be provided for all three phase controllers.
   a. Switch or dial selectable for motor running overload protection.
   b. Sensors in each phase.
   c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
   d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
   e. Analog communication module.

7. N.C. and N.O., isolated overload alarm contact.
8. External overload reset push button.

D. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Fusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate Class R fuses.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

3. Nonfusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.

2.2 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.

   1. Dry and clean Indoor Location: Type 1.
   2. Outdoor Locations: Type 3R.
   3. Pump Room and Pool Area: Type 4X, Stainless Steel.
   4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.3 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.

   2. Pilot lights: LED, color as indicated on the drawings; push to test.

B. N.C. and N.O. auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 16 Section "Electrical Supports."

B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

C. Install fuses in each fusible-switch enclosed controller.

D. Install fuses in control circuits if not factory installed. Comply with requirements in Division 16 Section "Fuses."

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 enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved nameplate.
3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and facility's central control system.

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.
   1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
   2. Connect selector switches with enclosed-controller 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. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. 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.

D. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

E. Tests and Inspections:
   1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
   2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
   3. Test continuity of each circuit.
   4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) 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 multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
   b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
   c. 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.
9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed controllers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING
A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

C. Set field-adjustable circuit-breaker trip ranges.

3.7 PROTECTION
A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.
3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 16420
SECTION 16442 – PANELBOARD CONTROLLERS

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. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. RFI: Radio-frequency interference.
D. RMS: Root mean square.
E. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, 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. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.
c. Short-circuit current rating of panelboards and overcurrent protective devices.
d. UL listing for series rating of installed devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
2. **Wiring Diagrams:** Power, signal, and control wiring.

C. **Qualification Data:** For testing agency.

D. **Field quality-control test reports including the following:**

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.

E. **Panelboard Schedules:** For installation in panelboards. Submit final versions after load balancing.

F. **Operation and Maintenance Data:** For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 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.

1.5 **QUALITY ASSURANCE**

A. **Testing Agency Qualifications:** An independent agency, with the experience and capability to conduct the testing indicated, that is a full member company of the InterNational Electrical Testing Association that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. **Source Limitations:** Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

C. **Product Options:** Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

D. **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.

E. Comply with NEMA PB 1.

F. Comply with NFPA 70.
1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F.
2. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no less than one week in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 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, and encumbrances to workspace clearance requirements.

1.8 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. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

   a. Square D is the basis for design.
   b. Eaton Corporation; Cutler-Hammer Products.
   c. Siemens Energy & Automation, Inc.
2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets. NEMA PB 1, Type 1.
   1. Rated for environmental conditions at installed location.
   2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
   3. Front Cover and Door: Provide piano hinged door and piano hinged trim.
   4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
   5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
   6. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

B. Phase and Ground Buses:
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material.
   1. Main and Neutral Lugs: Mechanical type.
   2. Ground Lugs and Bus Configured Terminators: Compression type.
   3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

D. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

E. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker.
C. Branch Overcurrent Protective Devices:
   1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
   2. 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.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
   3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
   1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Furnish portable test set to test functions of solid-state trip devices without removal from panelboard.

C. Fungus Proofing: Permanent fungicidal treatment for panelboard interior, including overcurrent protective devices and other components.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with front uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges.

E. Install filler plates in unused spaces.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. 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.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

D. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scanning of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
3. Record of Infrared Scanning: Prepare a certified report that identifies panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 16442
SECTION 16491 - FUSES

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. Cartridge fuses rated 600 V and less for use in switches, panelboards and controllers.
2. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 1 Sections, include the following:

a. Let-through current curves for fuses with current-limiting characteristics.

b. Time-current curves, coordination charts and tables, and related data.

c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

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. Fuses: Quantity equal to 10 percent of each fuse type and size, but no fewer than 6 of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussman, Inc.
2. Ferraz Shawmut, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 SPARE-FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch-thick 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: For each size of fuse.
5. Mount cabinet in main switchgear room.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Motor Branch Circuits: Class RK1, time delay.

B. Other Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet in main switchgear room.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 16491
SECTION 16511 - INTERIOR LIGHTING

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. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Lighting fixture supports.

B. Related Sections include the following:

1. Division 16 Section "Wiring Devices".

1.3 DEFINITIONS

A. BF: Ballast factor.
B. MH: Metal Halide
C. CRI: Color-rendering index.
D. CU: Coefficient of utilization.
E. HID: High-intensity discharge.
F. LER: Luminaire efficacy rating.
G. Luminaire: Complete lighting fixture, including ballast housing if provided.
H. RCR: Room cavity ratio.

1.4 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. Emergency lighting units including battery and charger.
5. Life, output, and energy-efficiency data for lamps.
6. Photometric data, in IESNA format, based on laboratory tests of each light fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

   a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

   b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.


C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Lighting fixtures.
   2. Suspended ceiling components.
   3. Structural members to which suspension systems for lighting fixtures will be attached.
   4. Other items in finished ceiling including the following:

      a. Air outlets and inlets.
      b. Speakers.
      c. Sprinklers.
      d. Smoke and fire detectors.
      e. Access panels.

   5. Perimeter moldings.

D. Provide submittal for the “Lighttruss” system indicated on the drawings.

E. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

   1. Lamps: Specified units installed.
   2. Accessories: Cords and plugs.

F. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.
G. Qualification Data: For agencies providing photometric data for lighting fixtures.

H. Field quality-control test reports.

I. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

J. Warranties: Full fixture warranty shall be two year(s) from date of Substantial Completion. Special warranties specified in this Section.

K. Warranty for Lightruss System: Full system warranty shall be one year from date of Substantial Completion.

1.5 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, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.6 COORDINATION

A. 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.

1.7 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

C. Special Warranty for T5 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Two year(s) from date of Substantial Completion.
2. Warranty Period for Lighttruss System: One year from date of Substantial Completion.

1.8 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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Battery and Charger Data: One for each emergency lighting unit.
4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
   a. SPI Lighting for Lighttruss system, No Substitutions.
   b. Lithonia for Emergency Battery Units, (Or Equal).

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

B. Fluorescent Fixtures Disconnect: Fixtures that utilize double-ended lamps and contain ballast(s) that can be served in place shall be provided with a disconnect means either internal or external to each luminaire, to disconnect simultaneously
from the source of supply all conductors of the ballast, including the grounded conductor. The line side terminals of the disconnecting means shall be guarded. The disconnecting means shall be located so as to be accessible to qualified persons before servicing or maintaining the ballast.

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. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

G. Plastic Diffusers, Covers, 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 0.187 inch minimum unless different thickness is indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

H. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Electronic Ballasts: Comply with ANSI C82.11; instant-start type, unless otherwise indicated, and designed for type and quantity of lamps served. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated.

1. Sound Rating: A.
2. Total Harmonic Distortion Rating: Less than 10 percent.
3. Transient Voltage Protection: IEEE C62.41, Category A or better.
4. Operating Frequency: 42 kHz or higher.
5. Lamp Current Crest Factor: 1.7 or less.
6. BF: 0.85 or higher.
7. Power Factor: 0.98 or higher.
8. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Single Ballasts for Multiple Lighting Fixtures: Factory-wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

C. Ballasts for Low-Temperature Environments:
   1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
   2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

D. Ballasts for Low Electromagnetic-Interference Environments: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for consumer equipment.

E. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.

2.4 BALLASTS FOR METAL-HALIDE LAMPS

A. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:

1. Lamp end-of-life detection and shutdown circuit.
2. Sound Rating: A.
3. Total Harmonic Distortion Rating: Less than 15 percent.
4. Transient Voltage Protection: IEEE C62.41, Category A or better.
5. Lamp Current Crest Factor: 1.5 or less.
6. Power Factor: .90 or higher.
7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
8. Protection: Class P thermal cutout.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.

1. Emergency Connection: Operate 4 fluorescent lamps continuously at an output of 825 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
2. Provide one iota EM battery pack per on 54 watt lamp.
3. **Night-Light Connection**: Operate one fluorescent lamp continuously.
4. **Test Push Button and Indicator Light**: Visible and accessible without opening fixture or entering ceiling space.
   a. **Push Button**: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. **Indicator Light**: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. **Battery**: Sealed, maintenance-free, nickel-cadmium type.
6. **Charger**: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
7. **Remote Test**: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
8. **Integral Self-Test**: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciacted by an integral audible alarm and flashing red LED.

### 2.6 EMERGENCY LIGHTING UNITS

#### A. Description: Self-contained units complying with UL 924.

1. **Battery**: Sealed, maintenance-free, nickel-cadmium type.
2. **Charger**: Fully automatic, solid-state type with sealed transfer relay.
3. **Operation**: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. **Test Push Button**: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. **LED Indicator Light**: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. **Wire Guard**: Heavy-chrome-plated wire guard protects lamp heads or fixtures. Provide where indicated on the drawings.
7. **Integral Time-Delay Relay**: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
8. **Integral Self-Test**: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciacted by an integral audible alarm and flashing red LED.
2.7  FLUORESCENT LAMPS

A. Low-Mercury Lamps: Comply with EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

B. T5 rapid-start low-mercury lamps, rated 54 W maximum, nominal length of 24 inches (610 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature 3500K, and average rated life 20,000 hours, unless otherwise indicated.

2.8  METAL HALIDE LAMPS

A. Metal Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature of 4000K.

B. Pulse start metal halide lamps, rated 400 watt maximum, 40,000 initial lumens (minimum), and average rated life 10,000 hours, unless otherwise indicated.

2.9  LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 16 Section "Electrical Supports" for channel-and angle-iron supports and nonmetallic channel and angle supports.

2.10  LIGHT TRUSS SYSTEM

A. Lighting system specifically intended for use in natatorium corrosive environments, UL listed as a system certified for use in damp locations. System shall be complete including all required supports, frames, pre-focused light modules, factory pre-wiring and all mounting hardware. System shall be modular with pre-assembled subsections. Equipment fastenings shall be stainless steel.

B. Mount and install lamps per manufacturer's recommendation and specifications with the following items:

1. Truss Sections:
   a. Truss Tubes: Size 2, with three metal tubes held in a triangular configuration by bulkheads, 1.5" diameter aluminum tubes, available in section lengths up to 10'.
   b. Wireway: Delivered pre-wired and factory assembled with #12 AWG. Power leads and section harness wiring shall be type MTW (105 degree C rate) conductors. Conductors and power feed locations shall conform to circuiting indicated on contract drawings. Factory wiring shall include multiple circuiting and 6 pin 94V-2 mate-n-lok connectors.
   c. Auxiliary Wireways: Provision for multiple circuits and/or switching, UL listed for damp locations.
d. Bulkhead: Die cast aluminum, provides vertical support of truss, point of attachment and adjustment for stainless steel cable or stem supports, has splice compartment with removable cover

e. Provide all transitions, radius bends, elevation changes, and variable length sections with associated connectors, brackets and necessary hardware to conform arrangements indicated on approval drawings.

2. Mounting:

a. Cable: Corrosion and heat-resistant Inconel aircraft suspension cable.


c. Canopy: 30° swivel and white plastic canopy; twist locks into position with not exposed fasteners; inner steel support bracket attaches to 4" octagonal box.

3. Light Modules

a. Module Components: Houses lamp(s), optical assembly and ballast; made from 0.25" extruded aluminum side panels and 0.25" cast aluminum end caps; stainless steel set screws secure module to truss tubes; are pre-wired pre focused and pre-assembled into the lighttruss system;

b. Symmetric Reflector for Metal Halide Lamps: Brightened and anodized, hydroformed, aluminum reflector with and impact and heat resistant tempered glass lens.


PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Lighttruss System:

1. Support truss sections every 10 feet with cable connected to the canopy 15 feet above floor level.

2. Install canopy to structural ceiling per manufacturer’s recommendation and specifications.

3. Install power feeder within the stem.

4. Provide non-corrosive finish rated for natatorium per manufacturer recommendations.

5. Provide all system components required for complete and operational system. Install per manufactures specifications.
C. Adjust aimable lighting fixtures to provide required light intensities.

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. 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.

END OF SECTION 16511