COUNTY OF BERKS

Invitation to Bid #26-16-GR
for
Renovations and Addition
to the
Keystone Regional Youth Center
for the
County of Berks

Issued on October 5, 2026

Pre-Bid Conference:
Wednesday, October 14, 2026, 1:00 P.M. Local Prevailing Time
Wednesday, October 21, 2026, 1:00 P.M. Local Prevailing Time
Refer to Instructions to Bidders, Article 4.4.1 for details.

Submittal Deadline:
Monday, November 16, 2026, 2:00 P.M. Local Prevailing Time
Refer to Instructions to Bidders, Clause 4 for submittal instructions.

Opening Date/Time:
Monday, November 16, 2026, 2:15 P.M. Local Prevailing Time

County's Point-of-Contact for this ITB:
Mr. George Rodrigues, Director of Contracts and Procurement
Tel: 610-478-6168 Fax: 610-898-7443
Email: grodrigues@berkspa.gov

Architect for this Project is:
USA Architects, Planners, and Interior Designers, Ltd.
Anthony Lauro
Tel:610-559-6000
Email: alauro@usaarchitects.com

Contract documents and drawings for the proposed work (the "Contract Documents", which have been prepared by the firm USA Architects, Planners and Interior Designers, Ltd. are available electronically at no cost by making a request to www.usaplanroom.com, project R2024.0111.01.

This Invitation to Bid (ITB) package consists of 1,222 pages including this cover page and the Table of Contents page. If the ITB package you received is missing any pages, contact the County of Berks Purchasing Department at telephone number (610) 478-6168.

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Invitation to Bid #26-16-GR
Renovations and Addition to the Keystone Regional Youth Center

The County of Berks is accepting sealed bids from qualified general, electrical, HVAC, and plumbing bidders for Renovations and Addition to the Keystone Regional Youth Center. Paper bids will be accepted by mail or hand delivery only at the following location:

County of Berks, c/o County Controller
Berks County Services Center
633 Court Street, 12th Floor
Reading, PA, 19601

Bids shall be received at the above location by 2:00 P.M., Monday, November 16, 2026. Oral, facsimile, and email bids are invalid and will not receive consideration.

Bids will be opened publicly at 2:15 P.M. Monday, November 16, 2026.

Members of the public are welcome to attend the bid opening for this Invitation to Bid (ITB) via Microsoft Teams. The meeting link is provided within the ITB document and is also available on the County of Berks Purchasing Department website under the listing for this specific ITB: https://www.berkspa.gov/departments/purchasing/itb-rfp.

Two pre-bid conferences will be conducted onsite at the Keystone Regional Youth Center located at 1261 County Welfare Road, Leesport, PA 19533. The first conference is scheduled for Wednesday, October 14, 2026 at 1:00 P.M., and the second for Wednesday, October 21, 2026 at 1:00 P.M. Prospective bidders are required to attend at least one of the two pre bid conferences.

Each bid submission must include bid security in the amount and form specified in the ITB package.

Bidders may download the ITB package from the plan room of USA Architects Planners and Interior Designers, at www.usaplanroom.com.

The County reserves the right to reject any or all bids or any part thereof and/or waive any informality in any bid received when such action is in the best interest of the County.

George M. Rodrigues
Director of Contracts and Procurement
Tel: 610-478-6168

COUNTY OF BERKS
Renovation and Addition
to the
Keystone Regional Youth Center

INSTRUCTIONS TO BIDDERS

ARTICLE 1 DEFINITIONS

1.1 Bidding Documents include, without limitation, the Drawings, Specifications, Invitation to Bid, Instructions to Bidders, Bid Form, Bid Bond, Payment Bond, Performance Bond, General Conditions, as modified by the Owner and bound herewith, and other Contract Documents.

1.2 All definitions set forth in the General Conditions of the Contract (AIA Document A201-2007, **as modified by Owner**) and any modifications thereto, or in other Contract Documents, are applicable to the Bidding Documents. Any modifications to the Bidding Documents will be issued via written Addendum.

1.3 Addenda are written and/or graphic instruments issued by the Owner or Architect prior to the submission of the Bid which modify or interpret the Bidding Documents, by additions, deletions, clarifications or corrections.

1.4 A Bid is a complete and properly signed Bid Form to do the Work for the sums quoted 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 quoted costs 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 by the Owner.

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

1.8 Base Bid Quantity Allowances are amounts to be included in the total lump sum bid and is based on a fixed quantity of a specific item that is offered by the Bidder via a cost per unit provided by the Bidder.

1.9 A Bidder is a person or entity who submits a Bid.

1.10 The term “Owner” is the County of Berks.

1.11 The term “Contract” and “Agreement” are used interchangeably.

1.12 The term "Architect" or "Architect/Engineer" as used in the Bidding Documents refers to:

1. USA Architects, Planners and Interior Designers, Ltd.
   1 South 3rd Street, 7th Floor
   Easton, PA 18047

1.13 The term "Construction Manager" as used in the Bidding Documents refers to:

1. Dolan Construction
   401 S 13th Street
   Reading, Pa 19602

ARTICLE 2 BIDDER'S REPRESENTATIONS

2.1 Each Bidder by making its Bid represents that:

2.1.1 It has read and understands the Bidding Documents and its Bid is made in accordance therewith.

2.1.2 It has visited the Project site, has familiarized itself with the local conditions under which the Work is to be performed such as locations, accessibility and general character of the site or building, the character and extent of existing Work within or adjacent to the site and any other Work being thereon at the time of submission of its Bid, and has correlated its observations with the requirements of the Contract Documents. The prevailing minimum wages as predetermined by the Pennsylvania Department of Labor and Industry, shall be paid to workmen employed in the performance of these Contracts.

2.1.3 Its Bid is based upon the materials, systems and equipment required by the entire set of Bidding Documents, without exception. Each Bidder is expected to carefully examine each and every Bidding Document in order to determine the exact nature and scope of its Work. Furthermore, each Bidder shall be responsible to review the Drawings and Specifications applicable to all trade contracts so the Bidder understands the extent of the Work of all of the trade contracts.

2.1.4 It is prepared to accept the Project in whatever condition it is in on the date the Contract is executed, without representation or warranty of any kind, express or implied, by the Owner or by any other person or entity. Bidder has examined and familiarized itself with all existing conditions including, without limitation, all applicable laws, permits, codes, ordinances, rules and regulations that will affect the Work.

2.1.5 It has visited the Project site and ascertained all conditions that will in any manner effect the Work. The Bidder has requested in writing any additional information from the Owner, Architect or any other party which it deemed necessary in order to be fully informed so as to be able to submit its Bid. The Owner makes no representation as to the accuracy or completeness of the information, which is furnished, and the delivery thereof shall not be deemed to constitute such a representation. Bidder has taken all steps necessary to satisfy itself as to the conditions of the Project and to include in its Bid

sufficient allocations for unknown or unidentified conditions. Any information furnished shall not be legally binding on the Owner unless issued by Addendum.

2.1.6 The Drawings have been prepared by the Architect on the basis of surveys and inspections of the Project, and represent a reasonably accurate indication of the physical conditions at the Project. This, however, does not impose responsibility therefore on the Owner and does not relieve the Bidder of the necessity for fully informing itself as to existing physical conditions. The Owner makes no representation as to the accuracy or completeness of such Drawings, and the delivery or use of such Drawings shall not be deemed to constitute such a representation.

2.1.7 It acknowledges that it is each Bidder's responsibility to resolve disputes and coordinate with all Contractors and Subcontractors (whether or not the Owner is a party to a contract with such Contractors or Subcontractors) which have performed or are performing Work at the Project. Similarly, each successful Bidder is responsible to such Contractors and Subcontractors which have performed or are performing Work at the Project if the Bidder's actions or omissions cause any damage or delay to such Contractors or Subcontractors.

2.1.8 It is thoroughly familiar with all conditions affecting labor at the Project, including, but not limited to, unions, incentive pay, procurement, living and commuting conditions, and wage decisions applicable to the Work. The Bidder assumes responsibility to the Owner for all costs resulting from the failure to verify all conditions effecting labor. The Bidder is responsible for the maintenance and observance of sound labor practices by itself and its Subcontractors, and shall take all steps reasonably necessary to avoid labor disputes and the potential delay and disruption arising therefrom.

2.1.9 No extra charge will be allowed for ignorance of Contract requirements or Project site conditions. The interrelationship of all Bidding Documents must be carefully examined.

2.1.10 It acknowledges that the Owner may undertake or award other contracts while the Bidder is performing the Work. The successful Bidder will need to coordinate its Work with that of other Contractors and/or Subcontractors on the Project. The Bidder acknowledges that it will need to coordinate its Work with that of the other Contractors and/or Subcontractors on the Project and has taken such obligation into account in submitting its Bid.

2.1.11 The submission of a Bid shall constitute conclusive evidence of compliance by such Bidder with above responsibility, and any claims relating to the established contract price, at any future time, for labor, equipment or materials required or for difficulties encountered which would or could have been foreseen had the Bidder so complied with its responsibility to ascertain all conditions and review all Bidding Documents, will not be recognized by the Owner.

2.1.12 Each Bidder, to the extent necessary, shall examine the Bidding Documents for which Bids are to be received and reviewed by the Owner, as specified herewith, which documents shall be available for inspection as set forth herewith, so that it may be

completely aware of all Work, materials and/or services which are to be provided by it to enable the completion of the Work in accordance with the Bidding Documents.

ARTICLE 3 BIDDING DOCUMENTS

3.1 COPIES

3.1.1 A complete set of Bidding Documents may be downloaded from the plan room of USA Architects Planners and Interior Designers, at www.usaplanroom.com as stipulated in the Invitation to Bid.

County's Point-of-Contact for this ITB:
George M. Rodrigues, Director of Contract Procurement
Tel: 610-478-6168 Fax: 610-898-7443
Email: grodrigues@berkspa.gov
Mailing Address: Purchasing Department,
13th Floor, Berks County Services Center
633 Court Street, PA, 19601

3.1.2 Bidders shall use a complete set of Bidding Documents in preparing Bids. Neither the Owner nor the Architect assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.1.3 The Owner and the Architect in making copies of the Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and performing the Work defined thereunder and do not confer a license or grant for use other than for the construction of the Project.

3.1.4 Bidders shall treat all bid-related information as confidential and shall not disclose or share it with anyone not directly involved in preparing the bidder's proposal or performing work related to this project. Bidders must ensure their employees, agents, advisors, subcontractors, and other representatives are informed of these confidentiality obligations and are bound by duties no less restrictive than those imposed on the bidder. Bidders are responsible for any breach committed by themselves or their representatives. Upon request, Bidders must promptly return or destroy all confidential bid materials, except for information retained solely as part of routine electronic backups until standard deletion occurs. Any unauthorized disclosure or misuse of bid-related information constitutes a breach. In the event of a breach, the County may pursue legal remedies in the state or federal courts located in Berks County, Pennsylvania; seek injunctive or other equitable relief and recover its reasonable attorney's fees and costs.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS.

3.2.1 Bidders shall promptly notify the Architect of any ambiguity, inconsistency or error, which they may discover upon examination of the Bidding Documents, or of the Project site and local conditions.

3.2.2 Bidders requiring clarification or interpretation of the Bidding Documents shall submit written requests to grodrigues@berkspa.gov via e-mail only, which shall reach the Architect no later than ten (10) business days prior to the date for receipt of Bids. No verbal questions from Bidders will be reviewed or accepted. Also, no questions will be received by the Owner. Any conflict, inconsistency, or discrepancy shall be reported to the Architect at least ten (10) days prior to submission of the Bid.

3.2.3 Any interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon such interpretations, corrections and changes.

3.2.4 It shall be the duty of each prospective Bidder to ascertain which Addenda, if any, has been issued and which Addenda, if any, may affect the Work to be covered by the Bid of such prospective Bidder.

3.3 SUBSTITUTIONS

3.3.1 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least fourteen (14) business days prior to the date for receipt of Bids. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including, but not limited to, drawings, cuts, performance test data, manufacturer's warranty and any other information necessary for an evaluation. A statement setting forth any changes in other materials, equipment or other Work that incorporation of the substitute would require shall be included. The burden of proof of the merit of the proposed substitute is upon the Bidder. The Architect's decision of approval or disapproval of a proposed substitution shall be final and binding.

3.3.2 If the Architect approves any 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.

3.3.3 The Bidder understands and agrees that if it did not elect to obtain approval during the bidding period as set forth above, the Owner has no obligation to review or consider submittals for substitutes after Contract award.

3.3.4 If approved substitutions require redesign or different quantity or arrangements of any part of the Project from that indicated in the Bidding Documents, all such additional labor, equipment, material and all new drawings and detailing required shall with approval of the Architect be the responsibility of the Contractor making the substitution at its own expense including, without limitation, services rendered by the Architect.

3.3.5 In the event that incorporation of a substituted item or assembly into the Work will require revisions or additions to the Work of other construction contracts, the Contractor electing to use such materials, products or assembly shall include the cost of such revisions or additions to the Work in its Bid.

3.4 ADDENDA

3.4.1 Addenda will be e-mailed to all planholders and posted on the website at www.usaplanroom.com .

3.4.2 No Addenda will be issued later than three (3) business days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponements of the date for receipt of Bids.

3.4.3 Each Bidder shall acknowledge receipt of all Addenda in its Bid by including a listing of same on the Bid Form.

3.4.4 Failure of any Bidder to receive such Addenda shall not relieve such Bidder from any obligation under its Bid as submitted.

ARTICLE 4 BIDDING PROCEDURE

4.1 FORM AND STYLE OF BIDS

4.1.1 Bids shall be submitted on the separate Bid Form included with the Bidding Documents for that purpose.

4.1.2 No Bid will be considered which is submitted other than on the Bid Form provided, or an exact copy thereof.

4.1.3 All blanks on the Bid Form, including, without limitation, for the Alternates and Unit Prices that may affect the Contract for which they are submitting a Bid shall be filled in by typewriter or manually in ink. Alternate Bids and Unit Prices shall have the price appearing in written form where indicated, along with corresponding price in numerical form. Where so indicated by the makeup of the Bid Form sums shall be expressed in both words and figures, and in case of discrepancy between the two, the amount written in words shall govern.

4.1.4 Any interlineation, alteration or erasure must be initialed by the signer of the Bid Form.

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

4.1.6 The Bidder shall sign and complete the Bid Form properly in accordance with the following.

1. If the Bidder is an individual the Bid Form shall be executed by him/her personally, his/her signature shall be witnessed, his/her business address shall be stated, and any trade name employed in the conduct of his/her business shall be stated.

2. If the Bidder is a partnership, the Bid Form shall be executed in the name of the partnership by one or more of the authorized general partner(s), the signature(s) shall be witnessed and the business address of the partnership shall be stated.

3. If the Bidder is a corporation, the Bid Form shall be executed in the name of and on behalf of the corporation: (1) by the President or a Vice President and attested to by the Secretary, Assistant Secretary, Treasurer or Assistant Treasurer and the corporate seal shall be affixed: or (2) by a duly authorized agent of the corporation whose authority to act, as of the date of the Bid, shall be established by proof, in form satisfactory to the Owner, submitted with the Bid Form, the business address of the corporation shall be stated, the state of the incorporation shall be stated, and, if the corporation is a foreign non-Pennsylvania corporation, whether the corporation is registered to do business in Pennsylvania shall be stated.

4. Three (3) copies of the Bid Form along with three (3) copies of any required information must be submitted at the time of bid.

4.1.7 Bids shall not contain any recapitulations of the Work to be performed. Bidder shall make no stipulation on the Bid Form nor qualify its Bid in any manner.

4.1.8 The Bid, Bid Form, Bid Bond Form and related Bid Security payment and other required documents, shall be enclosed in a sealed opaque envelope and addressed clearly on the face of the envelope as follows:

(Upper Left Corner)
Bidder's Name
Address

(Center of Envelope)
County of Berks
Attention: County Controller
Berks County Services Center
633 Court Street, 12th Floor
Reading, PA 19601

(Lower Left Corner)
Renovations and Addition to the Keystone Regional Youth Center
Bid for: (General Construction/Plumbing/HVAC/or Electrical)
Owner: County of Berks

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. The Bidder assumes all responsibility for the timely delivery of any mailed Bids sent via Courier Services.

4.1.9 Bids shall be deposited and addressed to the attention of the County Controller, County of Berks, Berks County Services Center, 633 Court Street, 12th Floor, Reading, Pennsylvania 19601 until the time and date stated in the Invitation to Bid, or any

extension thereof made by Addendum. Bids received after the time and date for receipt of Bids will be returned unopened.

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

4.1.11 Oral, facsimile, and email bids are invalid and will not receive consideration.

4.2 BID SECURITY

4.2.1 Each Bid Form must be accompanied by cash, Bid Bond in the form included herein, certified good faith check, bank check, cashier's check or treasurer's check in the amount of ten percent (10%) of the total amount of the Bid drawn to the order of the County of Berks. The proceeds thereof will be retained by the County of Berks as liquidated damages if the successful Bidder shall fail to execute the Contract and furnish the required Performance Bond and Payment Bond, and/or fail to provide appropriate proof of insurance. The carriers from whom the Contractor has purchased the required bonds must be listed in the most recent U.S. Treasury Department Circular and the amount of said bonds in question must not exceed the acceptable limit therein recommended for bonds. The Owner reserves the right to retain the security of the next two (2) lowest Bidders until the lowest Bidder enters into a Contract and furnishes the required Performance Bond and Payment Bond, and furnishes appropriate proof of insurance. NOTE: a Bidder's personal check or non-certified corporate check is not acceptable as a form of Bid Security. Failure to accompany this Bid with the appropriate Bid Security will automatically disqualify Bidder.

4.2.2 The Owner shall retain the Bid Security of the lowest responsive, responsible Bidder.

4.2.3 Bid Security shall remain in effect during the time period stipulated in Paragraph 4.3.1 or until the furnishing of Performance Bond and Payment Bond, the requisite insurance, and the executed Contract for the applicable Work for which the Bid was submitted.

4.2.4 Bid Security shall be submitted with the understanding that the same shall guarantee that the Bidder, prior to execution of the Contract, will deliver to the Owner Performance Bond and Payment Bond in the forms bound herewith, as required by the Contract Documents, and shall enter into the Contract, in the form bound herewith, and shall furnish evidence of insurance coverage in accordance with applicable provisions of the conditions bound herewith. In the event the Bidder shall fail to comply with any part of the foregoing, the Owner may declare the Bidder to be in default with respect to its Bid.

4.2.5 In the event any Bidder shall be declared to be in default with respect to its Bid, the proceeds thereof will be retained by the County of Berks as liquidated damages.

4.3 MODIFICATION OR WITHDRAWAL OF BID.

4.3.1 A Bid may not be modified, withdrawn or canceled by the Bidder for sixty (60) days after the opening of the bids and each Bidder so agrees in submitting its Bid, unless the award of the Contract is delayed due to required approvals of other governmental agencies, or

sale of bonds, in which case, Bids shall be irrevocable for one hundred twenty (120) days in compliance with Act 1978-317, approved November 26, 1978.

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

4.4 PRE-BID CONFERENCES

4.4.1 Prospective bidders are required to attend at least one of the two pre bid meetings scheduled at the Keystone Regional Youth Center, located at 1261 County Welfare Road, Leesport, PA 19533, on Wednesday, October 14, 2026, at 1:00 P.M., and Wednesday, October 21, 2026, at 1:00 P.M. All attendees must sign the official attendance sheet provided. Any bidder who does not attend one of the mandatory pre bid meetings or fails to sign the official attendance sheet will be ineligible to submit a bid, and any bid received from a non-attending bidder will be rejected as non-responsive.

ARTICLE 5 CONSIDERATION OF BIDS

5.1 OPENING OF BIDS

5.1.1 The properly identified Bids received on time will be opened publicly and read aloud at the time and place noted in the Invitation to Bid.

5.1.1.1 Members of the public may attend the bid opening for this Invitation to bid via Microsoft Teams. The link and information for the meeting is https://teams.microsoft.com/meet/289865673490584?p=4A1nONDuxAiSHP5AAQ The meeting ID is 289 865 673 490 584 and the passcode is pG7dW3Fy. The dial in by phone number is 1-717-481-3891, the conference ID number is 747 009 168#.

5.1.2 If any discrepancy exists in the Bid between numbers as written in words and as written Roman or Arabic numerals, the written words will control.

5.2 REJECTION OF BIDS

5.2.1 Any Bid which contains omissions, additions or deductions not called for or permitted, alteration of forms, conditional or uninvited alternate proposals or irregularities of any kind may be rejected by the Owner, and any Bid which is not based upon the Bidding Documents and any Bid which, while otherwise regular in form, shall not be accompanied by proper Bid Security may be rejected by the Owner, in its sole and absolute discretion.

5.2.2 The Bidder, in the completion of the Bid Form, shall insert Unit Prices where applicable. In the event any Unit Price, in the opinion of the Owner, is unreasonable or unbalanced, the Owner reserves the right to refuse or re-negotiate any or all such Unit Prices.

5.2.3 The Bid of any Bidder or Bidders who engage in collusive bidding shall be rejected. Any Bidder who submits more than one proposal in such manner as to make it appear that the proposals submitted are not on a competitive basis from different parties shall be considered a collusive Bidder. The Owner may reject the Bid of any collusive Bidder upon Bid opening. However, nothing in this section shall prevent a Bidder from superseding a Bid by a subsequent Bid delivered prior to Bid opening which expressly revokes the previous Bid.

5.2.4 The Owner may waive irregularities in a Bid, but is under no obligation to do so.

5.2.5 The Owner shall have the right to reject any or all Bids for any reason whatsoever and to reject a Bid not accompanied by any data required by the Bidding Documents, to reject a Bid which is in any way incomplete, irregular or otherwise not responsive to the requirements of the Bidding Documents, or to reject the Bid of a Bidder who is not qualified in accordance with the requirements of the Bid. The Owner reserves the right to waive any informalities and technicalities in bidding and reserves the right to act in its own best interest. Without limiting the foregoing, the Owner shall have the right to reject a Bid if the Bidder has failed to comply with all applicable standards, codes, laws, ordinances, regulations and/or requirements of any state, federal or other agency on any previous project.

5.2.6 If for any reason whatsoever, the Owner rejects Bidder's Bid, Bidder agrees that it will not seek to recover profits on Work not performed nor will it seek to recover its Bid preparation costs.

5.3 ACCEPTANCE OF BID (AWARD)

5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive, responsible Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. Determination of which Bid is the lowest responsive, responsible Bid shall be made by the Owner and calculated by taking into consideration the total lump sum bid, plus any Alternates accepted. The Owner may also consider other factors which it feels have bearing on the Project including, without limitation, the Bidders failure to comply with all applicable standards, codes, laws, ordinances, regulations, and/or requirements of any state, federal or other agency on previous projects.

5.3.2 In the event of a dispute between a Bidder and the Owner regarding the Owner's determination of which Bidder is the lowest responsive and responsible Bidder, such contesting Bidder shall be responsible for any legal fees (e.g., fees of attorneys, paralegals and other legal professionals), professional fees, or other costs or expenses incurred by the Owner resulting from or arising out of the contesting Bidder's dispute of the Owner's determination of which Bidder is the lowest responsive and responsible Bidder. The contesting Bidder shall pay such legal fees, professional fees, or other costs or expenses within seven (7) days of receipt of the Owner's invoice. Furthermore, under no circumstances shall the Owner be responsible for any legal fees, professional fees, or other costs or expenses incurred by the contesting Bidder if the Owner decides not to Award the Contract to such Bidder based upon the Owner's determination in its sole and

absolute discretion that such contesting Bidder is not the lowest responsive and responsible Bidder.

ARTICLE 6 POST BID INFORMATION

6.1 PROOF OF BIDDER'S RESPONSIBILITY

6.1.1 No Contract will be awarded to any person, firm or corporation that is in arrears, in litigation with the Owner or in default to the Owner.

6.2 SUBMITTALS

6.2.1 The Bidder shall, within five (5) calendar days of Notice of Intent to Award a Contract for the Work, submit the following information to the Architect: See Document 01 33 00.

1. The proprietary names and the suppliers of principal items or systems of materials and equipment proposed for the Work;

2. A list of names of the Subcontractors and/or Sub-Subcontractors, 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 if the same have been selected.

3. A separate and complete Verification Form required by the Public Works Employment Verification Act, Act No. 127, July 5, 2012 (formerly Senate Bill 637) for itself and each of the proposed Subcontractors (as such term is defined therein) acknowledging its responsibilities and its compliance with the Public Works Employment Verification Act as a precondition of the Owner's Award of the Contract. The Verification Form shall be obtained from the Secretary of the Pennsylvania Department of General Services and shall include a certification that the information is true and correct, subject to sanctions provided by law. The respective Verification Form shall be executed by a representative who has sufficient knowledge and authority to make the representations and certifications contained in the Verification Form.

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

6.2.3 Prior to the Award of the Contract, the Architect will notify the Bidder in writing if the Architect or Owner, after due investigation, have reasonable objection to any such proposed person or entity proposed to furnish and perform the Work described in the Bidding Documents. If either the Architect or Owner has reasonable objection to any such proposed person or entity, the Bidder shall submit an acceptable substitute person or entity for approval by the Architect or Owner with no adjustment in the Bid price.

6.2.4 Persons and entities proposed by the Bidder and to whom the Architect has made no reasonable objection under the provisions of Subparagraph 6.2.3 must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Architect and Owner.

ARTICLE 7 BONDING

7.1.1 Prior to the execution of the Contract, the successful Bidder shall furnish and pay for the surety bonds in the form found herewith. The County of Berks shall be named as obligee under the surety bonds. Costs of bonds shall be included in the Base Bid.

7.1.2 The stated principal amounts applicable to the contract bonds required shall be as follows:

1. Performance Bond – One hundred percent (100%) of the amount of the Contract Sum.

2. Payment Bond – One hundred percent (100%) of the amount of the Contract Sum.

7.1.3 The surety bonds required shall have as surety thereon a corporation duly authorized to conduct business in Pennsylvania and which is in accordance with the Contract Documents.

7.1.4 The surety bonds shall be executed on behalf of the surety in such manner as shall legally bind the surety. In the event the execution on behalf of the surety is by an agent or agents, a proper power of attorney evidencing the authority of such agent or agents shall be attached to the surety bonds. Such power of attorney shall bear the same date as the surety bonds to which it is attached.

7.2 TIME OF DELIVERY AND FORM OF BONDS.

7.2.1 The Bidder shall deliver the required bonds to the Owner as set forth elsewhere in the Contract Documents, but in no event later than the date of execution of the Contract.

ARTICLE 8 FORM OF CONTRACT

8.1 FORM TO BE USED

8.1.1 The form of the Contract is included in the Contract Documents.

8.1.2 The Contract shall be executed by or on behalf of the successful Bidder in the following manner:

1. If the successful Bidder is an individual, the form of the Contract shall be executed by it personally, its signature shall be witnessed and any trade name employed in the conduct of its business shall be stated.

2. If the successful Bidder is a partnership, the form of the Contract shall be executed, in the name of the partnership; by one or more of the authorized general partners and the signature of the general partner(s) shall be witnessed.

3. If the successful Bidder is a corporation, the form of the Contract shall be executed in the name of and on behalf of the corporation by: (1) the President or a Vice President and attested to by the Secretary, Assistant Secretary, Treasurer or Assistant Treasurer and the corporate seal shall be affixed; or (2) a duly authorized agent of the corporation whose authority to act, as of the date of the form of the Contract, shall be established by proof, satisfactory to the Owner attached to the form of the Contract.

8.1.3 The form of the Contract will be executed by the County of Berks, as Owner.

8.1.4 The Project Manual, as well as all other Contract Documents, shall apply to this Contract.

ARTICLE 9 DURATION OF CONTRACTS

9.1 ESCALATION

9.1.1 The Bid for each Contract must be guaranteed for the duration of this Project, and shall thereby have incorporated within it any or all escalation factors related to market conditions. Notwithstanding any other provision in the Contract Documents to the contrary, each Contractor's Contract Sum is intended to include all increases in cost, foreseen or unforeseen, including, without limitation, increases in costs arising from supply shortages, unusual delay in deliveries, increases in market prices for materials, labor, taxes and/or other causes beyond the Owner's control, all of which are to be borne solely by the applicable Contractor supplying the materials and/or labor to the Project. All loss and/or damage arising from any of the Work performed under this Agreement through unforeseen or unusual obstructions, difficulties or delays which may be encountered in the prosecution of same shall be borne solely by the applicable Contractor prosecuting the Work.

9.2 CONTRACT SCHEDULING

9.2.1 Time is of the essence in completing all Work under the Contract.

9.2.2 In preparing the Project schedule, the Construction Manager or its agents, shall have the right to assign start times, completion times and intermittent out-of-sequence adjustments in an effort to complete the Work within the time frame in the Project schedule. All sequencing, directions and dates indicated are approximate and are subject to change by Owner without additional compensation to the successful Bidder. The Bidder understands and has incorporated into its Bid the fact that the attached schedule information is provided for milestone and general sequencing information only. Responsibility for coordination of the schedule and coordination of the Work rests solely with the various Contractors. The Bidder in making its Bid acknowledges that absolutely no claims will be considered by the Owner for additional costs for coordination of the schedule or lack thereof.

9.3 TIME FOR COMMENCEMENT AND COMPLETION

The Work shall be completed within the schedule stipulated in the Bidding Documents. If it becomes necessary in the opinion of the Owner to postpone the Project or any phase of the Work, then the Owner may authorize an extension of the Contract Time. An extension of the Contract Time shall not be cause for an increase in the Contract Sum paid to the Contractor.

9.4 The Contractor shall begin work within five (5) days from the date of issuance of the Notice to Proceed by the Owner.

9.5 CONSTRUCTION TIME AND LIQUIDATED DAMAGES

The Contract between the Owner and Contractor will include a stipulation that the Work be completed in the time period specified in the Contract Documents. The Contract also includes a stipulation regarding liquidated damages in Paragraph 9.11 of the General Conditions.

9.6 NO DAMAGES FOR DELAY

The Contractor shall not be entitled to additional costs or damages even if the Contractor's performance of Work on the Project is delayed without fault on the Contractor's part, because of any event which is beyond the control of the Contractor such as area-wide labor disputes, extraordinarily severe weather, acts of God or other force majeure, even if the Contractor would have otherwise been able to perform all of its obligations under the Contract but for such delay.

No extension of time shall be allowed for any suspension, delay or interruption to the extent: (1) that performance would have been so suspended, delayed or interrupted by any other cause, including, but not limited to, the fault or negligence of the Contractor; or (2) for which any adjustment is expressly provided for or excluded by any other provision of the Contract.

ARTICLE 10 TAXES

10.1 The Bids shall include, without limitation, all Federal, State (including, without limitation, Pennsylvania Sales Tax, to the extent applicable), County and Municipal taxes imposed by law and will be collected and paid for by the Contractor.

ARTICLE 11 INSURANCE

11.1 Reference is made to the insurance requirements of the General Conditions bound herewith for provisions relating to insurance which shall be provided and maintained by the Contractor during the period of performance under the Contract.

11.2 Bidders must provide with their bid a sample certificate of insurance evidencing, at minimum, the insurance coverage types and levels set forth in this ITB.

11.3 The Contractor shall comply with applicable requirements for insurance before commencing performance of Work under the Contract, and, as proof of such compliance, shall deliver to the Owner proper certificates in accordance with the terms set forth as the insurance requirements in the General Conditions.

11.4 The Contractor's General Liability policy shall include the CG2503 Designated Construction Project's Aggregate Limit or its equivalent.

ARTICLE 12 CONTRACT EXECUTION

12.1 The form of the Contract and the surety bonds will be delivered to the successful Bidder for execution. These, along with any additionally required documents, must be completed and returned to the Owner by 5:00 PM on the seventh (7th) full calendar day after the Award of Contract by the Owner. Failure to comply with this instruction may be grounds for rejection of the Bid.

ARTICLE 13 ALTERNATES

13.1 The scope of Work of each requested alternate is described in the Bidding Documents. Bids shall be submitted only on the basis of materials, products, or equipment specified in the Bidding Documents, or subsequently approved and included in Addenda pursuant to formal written requests for substitution.

13.2 Alternate Bids shall include, without limitation, the difference in price (addition or deduction) from the Base Bid, for substituting, omitting or changing materials or construction required by the Bidding Documents as part of the Base Bid construction and work.

13.3 The difference in price shall include, without limitation, all omissions, additions, and adjustments of all trades as may be necessary because of each change from the Base Bid construction and Work.

13.4 Each Contractor will be required to coordinate pertinent related Work and modify surrounding Work as required to complete the Project under each alternate designated in the Contract. In the event that incorporation of a substituted item or assembly into the Work will require revisions or additions to the Work of other construction contracts, the Contractor electing to use such materials, products, or assembly shall include the cost of such revisions or additions to the Work in its Bid.

13.5 Each Contractor is required to submit an Alternate Bid for each alternate. If no change in the Base Bid is required, enter "No Change".

ARTICLE 14 UNIT PRICES

14.1 The Bid Form shall include all Unit Prices stated in the Contract Documents. Each Unit Price filled in by the Bidders on the Bid Form shall represent full compensation per unit

of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work stipulated in the Contract Documents are increased or decreased. Listing of more than one cost figure per Unit Price, or modification of the Bid Form to accommodate more than one cost figure per Unit Price, will render the Bid non-responsive and may be cause for rejection of the Bid, as determined by the Owner in its sole and absolute discretion.

14.2 The Unit Prices shall include all costs required to perform the Work designated in the Unit Price, including, without limitation, all labor, material, equipment, insurance, taxes, overhead, profit, mark-ups, and all other General Condition items.

14.3 The Unit Prices shall strictly be used upon the written direction of the Architect.

14.4 The Unit Prices shall be applied for both credits or deletions to the Work or for additions to the Work.

14.5 Prior to the Award of the Contract, the Owner reserves the full right to accept or reject any or all Unit Prices.

ARTICLE 15 ALLOWANCES

15.1 Each Contractor shall include in its Bid the designated Base Bid Quantity Allowance amounts. The Base Bid Quantity Allowance values shall be included in the total lump sum bid.

15.2 The Architect will authorize in writing the expenditure of any of these Base Bid Quantity Allowance amounts.

15.3 The Contractor will not be allowed to spend any of the Base Bid Quantity Allowance amounts without the prior written authorization of the Architect. Failure on the part of the Contractor to adhere to this provision will cause the Contractor to not be reimbursed for Work completed but not authorized.

15.4 The Base Bid Quantity Allowance amounts will be adjusted via Change Orders to reflect the amount actually expended. Any unexpended amounts of the Base Bid Quantity Allowance amounts will be returned in full to the Owner via deduct Change Order.

ARTICLE 16 NON-COLLUSION AFFIDAVIT

16.1 Each Bidder shall complete and submit the Non-Collusion Affidavit, included in the Contract Documents, in accordance with the following:

1. The Non-Collusion Affidavit is material to any contract awarded pursuant to this Bid. According to the Pennsylvania Anti-Bid-Rigging Act, 73 P.S. 1611 et seq., governmental agencies may require Non-Collusion Affidavits be submitted together with Bids.

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

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

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

5. The term "complementary bid" as used in the Affidavit has the meaning commonly associated with that term in the bidding process, and includes the knowing submission of Bids higher than the Bid of another firm, any intentionally high or non-competitive Bid, and any other form of Bid submitted for the purpose of giving a false appearance of competition.

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

ARTICLE 17 SECURITY PROTOCOLS

Bids shall be submitted on the basis of full and total compliance with the security protocols applicable to the Project site, including, but not limited to, the Security Protocols set forth in the Contract Documents.

ARTICLE 18 MOLD REMEDIATION

Intentionally left blank as this is not applicable to this project.

ARTICLE 19 GOVERNING LAWS AND REGULATIONS

Bids shall be submitted on the basis of full and total compliance with all federal, state, county, and local laws, regulations, statutes, and requirements pertaining to this Project, including, but not limited to, the "Statutory Requirements" portion of Article 15 of the General Conditions.

ARTICLE 20 INABILITY TO CONSUMMATE FINANCING OR PROCEED

The Work to be performed for this Project is public work, financed by the Owner (a public body) by issuance of certain bonds, the issuance of which is subject to various qualifications and restrictions. The Owner, in good faith, intends to consummate such financing, but its ability to do so is subject to many factors beyond its control. It is therefore expressly understood and agreed to by each Bidder that, notwithstanding any other provision of the Contract Documents,

the Owner may cancel any award made by it or cancel any Contract entered into with any Bidder without liability to the Bidder, at any time before the Bidder has been given written notice to proceed and has actually begun Work under the Contract, if financing satisfactory to the Owner cannot reasonably be consummated as contemplated or if any court of competent jurisdiction shall enjoin or otherwise prohibit the Owner from proceeding with the Work.

END OF DOCUMENT

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

BID FORM – GENERAL CONSTRUCTION

County of Berks
Controller's Office
Berks County Services Center
633 Court Street, 12th Floor
Reading, PA 19601

DATE _____

BIDDER _____

Attn: County Controller

Re: Renovations and Addition to the Keystone Regional Youth Center

The following Bid is submitted in response to your Invitation to Bid.

This Bid is submitted by:

Company Name: _____

Company Address: _____

_____

_____

Main Telephone: _____

Main Fax: _____

Communications and questions concerning this bid are to be directed to:

Contact Name / Title: _____

Contact Telephone: _____

Fax: _____

Contact Email: _____

Bidder's Handwritten Initials _____

In the event our company is awarded a contract as a result of the ITB and this bid, the following individual will serve as project liaison/manager:

Name / Title: _____

Office Address: _____

_____

_____

Telephone: _____

Fax: _____

Email: _____

This Bidder agrees to furnish the bonds required by Article 11, Paragraph 11.4 of the General Conditions, as modified by the Owner. Bid Security in the amount required by the Instructions to Bidders is enclosed. It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within seven (7) days after notification of Award of Contract, enter into a Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

This Bidder has carefully examined the Bidding Documents and the Project site, and certifies that it fully understands the requirements thereof. This Bidder agrees that, after notification of Award of Contract, it will furnish and deliver materials, water, tools, equipment, light, heat, power, tests, transportation, secure permits and licenses, do and perform labor, superintendence and means of construction, pay fees and do incidental Work, and execute, construct and finish the aforesaid in an expeditious, substantial and workmanlike manner, in accordance with the Bidding Documents to the complete satisfaction and acceptance of the Owner for the price hereinafter stated.

As set forth in Article 8, Subparagraph 8.2.4 and Article 9, Subparagraph 9.11 of the General Conditions, Bidder submits this Bid with the understanding that the Renovation and Addition to the Keystone Regional Youth Center encompassed in the Bidding Documents shall be commenced immediately upon receipt of the Notice to Proceed and shall be fully and finally completed in accordance with the Project schedule established by the Owner, and that time for the completion of the Work shall be considered as of the essence of this Contract, and that for the costs of extra inspections, salaries of contingent forces and other expenses entailed by the Owner by delay in completing the Contract, said Owner shall be entitled to access liquidated damages in the fixed sum of Two Thousand Five Hundred Dollars ($2,500.00), per Contractor, per calendar

day, for the first Seven (7) days after the established completion deadline, Five Thousand Dollars ($5,000.00), per Contractor, per calendar day, for the following Seven (7) days, and Seven Thousand Five Hundred Dollars ($7,500.00), per Contractor, per calendar day, for each day thereafter until the Date of Substantial Completion as liquidated damages for each and every days' delay, not caused by the Owner. The Owner may, at the Owner's discretion, retain these liquidated damages from any payments due to the Contractor. This provision shall apply to each and every phase of construction.

In addition to the foregoing and without limiting the foregoing, the Contractor and Contractor's Surety shall be jointly and severally liable for and shall pay the Owner the costs incurred by the Owner resulting from the Contractor's delay in submitting Shop Drawings, Product Data, Samples and similar submittals beyond the required number of days specified for such submittals as provided in the Contract Documents as liquidated damages, and not as a penalty, in the amount of Five Hundred Dollars ($500.00) per calendar day, for each calendar day of delay until such submittal has been properly submitted as provided in the Contract Documents. The Owner may, at the Owner's discretion, retain these liquidated damages from any payments due to the Contractor. All submittals shall be received from the Contractors by the earlier of the date set forth in the Contract Documents, if applicable, or within ninety (90) days of the Notice to Proceed.

Bidder understands that the Award of Contract will be preconditioned on submittal to the Owner and the Architect, of a Certificate of Insurance as outlined in the General Conditions, within seven (7) days after notification of Award of Contract is received by this Contractor.

Bidder understands the following supplements to the Bid Form must be submitted concurrent with this bid submission.

Bid Bond Form and Consent of Surety
Substitution List
Non-Collusion Affidavit
Bidder's Qualifications (AIA Document A305, 1986 edition)
Bidder's Qualification Form Supplement
Bidder's Financial Disclosure Form
Sample Certificate of Insurance evidencing limits required herein
Worker Protection and Investment Certification Form BOP-2201
Commonwealth of Pennsylvania Public Works Employment Verification Form for Bidder

Bidder understands the following supplement to the Bid Form must be submitted within seven (7) calendar days after receipt of the Notice of Intent to Award.

Equipment Suppliers List
Subcontractors List

Bidder's Handwritten Initials _____

Employment Verification Form as required by Act No. 127
Performance Bond
Payment Bond
Certificate of Insurance evidencing the limits and including the additional insured language required herein

It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within **(i) five (5) days after the Notice of Intent to Award a Contract submit the Verification Forms required by the Public Works Employment Verification Act on behalf of itself and each of its Subcontractors and (ii)** seven (7) days after notification of Award of Contract, enter into a Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

This Bid is submitted with the definite understanding that Bids are valid for acceptance by the Owner and may not be withdrawn for a period of at least sixty (60) days after the actual date of the opening thereof unless the award of the Contract is delayed due to required approvals of other governmental agencies, or sale of bonds, in which case, Bids shall be irrevocable for one hundred twenty (120) days in compliance with Act 1978-317, approved November 26, 1978.

It is understood that the Owner reserves the right to reject any or all Bids, or part thereof or items therein, and to waive technicalities required for the best interests of the Owner. Omission of any information may be sufficient cause for rejection of this Bid. It is further understood that competency and responsibility of Bidders will receive consideration before the Award of Contract.

The undersigned will not assign his Bid or any of his rights or interests thereunder without the written consent of the Owner.

The Base Bid and other required information are submitted in the spaces provided. Handwritten initials on each page of this Bid Form identify each as a part of this Bid.

BASE BID

The sum of _____Dollars

(includes Allowances listed below)

($_____) for the County of Berks Renovations and Addition to the Keystone Regional Youth Center Project.

Bidder's Handwritten Initials _____

ALLOWANCES – See Section 01 21 00

The Bidder Certifies that the aforementioned allowances are INCLUDED in each Bid Amount.

1. Allowance GC1: Subcontractor Allowance for Door Hardware: (to be issued via Addendum)

ALTERNATES

The following listed alternate prices shall be filled in and submitted with the Bid Form. It is agreed that all Work to be performed under accepted alternate prices shall conform to the applicable Contract Documents, and shall include all Work in connection with or consequent to the alternate price Work to produce a complete installation.

Alternate prices shall be inclusive of the cost of materials, work, profit, supervision, administration and any and all other costs in connection therewith for Work in place and accepted or omitted as the case may be, and shall hold for the same period as the Bid.

The undersigned hereby proposes the following prices for Alternates, the selection of which shall be at the Owner's option:

Alternate No. GC-01: Repainting Barrel Vault Standing Seam Metal Roofs: ADD the cost of work associated with the cleaning, surface rust removal, preparation, priming and finish painting of approximately 885 square feet of existing barrel vault roofs.

ADD _____ Dollars ($_____)

UNIT PRICES

The Contractor is required to bid unit prices on the following items as identified below. If any extra Work is required in these categories beyond the Contract requirements, the unit prices shall be used as a basis for determining the amount of additional payment to the Contractor. If any deletions are to be made in these categories, the unit prices shall be used as the basis for determining the credit the Owner is entitled to receive. The Owner reserves the right to reject any unit price which is unreasonable or unbalanced, as compared with prevailing costs, or as compared with the unit prices submitted by the other bidders for this Project. The Owner reserves the right to ask for a revised unit price before or after the Contracts are signed.

Bidder's Handwritten Initials _____

Unit Price GC-01: Sealing of Floor Cracks **$_____/lineal foot**

Unit Price GC-02: Exterior Sealants **$_____/lineal foot**

Unit Price GC-03: Security Ceiling **$_____/square foot**

Unit Price GC-04: Detention Door Locks **$_____/Lock Set/Door**

Unit Price GC-05: Replace Asphalt Shingles **$_____/square foot**

Unit Price GC-06: Replace Lightening Arrestor Points **$_____/point**

ADDENDA

The Bidder acknowledges receipt of Addenda listed below which have been issued during the bidding period and agrees that said Addenda shall become part of the Contract (Bidder shall list numbers and dates of Addenda received).

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

IDENTIFICATION OF BIDDER

Company _____ Phone_____

Address _____

_____

Please check the appropriate category:

_____ Sole Proprietorship _____ Partnership
_____ Pennsylvania Corporation _____ Foreign Corporation Registered in PA

Bidder's Handwritten Initials _____

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

SIGNATURES

COMPANY NAME

FEDERAL ID#_____

_____

STREET ADDRESS PO BOX CITY STATE ZIP

_____ _____

TELEPHONE # FAX #

Witness or Attest:

_____ _____

An Officer, if Bidder is corporation, if not Owner, Partner, or President/Vice President* corporation, any competent adult

* Bidder to circle appropriate term.

END OF DOCUMENT

Bidder's Handwritten Initials _____

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

BID FORM – PLUMBING CONSTRUCTION

County of Berks
Controller's Office
Berks County Services Center
633 Court Street, 12th Floor
Reading, PA 19601

DATE
_____

BIDDER
_____

Attn: County Controller

Re: Renovations and Addition to the Keystone Regional Youth Center

The following Bid is submitted in response to your Invitation to Bid.

This Bid is submitted by:

Company Name: _____

Company Address: _____

_____

_____

Main Telephone: _____

Main Fax: _____

Communications and questions concerning this bid are to be directed to:

Contact Name / Title: _____

Contact Telephone: _____

Fax: _____

Contact Email: _____

Bidder's Handwritten Initials _____

In the event our company is awarded a contract as a result of the ITB and this bid, the following individual will serve as project liaison/manager:

Name / Title: _____

Office Address: _____

_____

_____

Telephone: _____

Fax: _____

Email: _____

This Bidder agrees to furnish the bonds required by Article 11, Paragraph 11.4 of the General Conditions, as modified by the Owner. Bid Security in the amount required by the Instructions to Bidders is enclosed. It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within seven (7) days after notification of Award of Contract, enter into a Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

This Bidder has carefully examined the Bidding Documents and the Project site, and certifies that it fully understands the requirements thereof. This Bidder agrees that, after notification of Award of Contract, it will furnish and deliver materials, water, tools, equipment, light, heat, power, tests, transportation, secure permits and licenses, do and perform labor, superintendence and means of construction, pay fees and do incidental Work, and execute, construct and finish the aforesaid in an expeditious, substantial and workmanlike manner, in accordance with the Bidding Documents to the complete satisfaction and acceptance of the Owner for the price hereinafter stated.

As set forth in Article 8, Subparagraph 8.2.4 and Article 9, Subparagraph 9.11 of the General Conditions, Bidder submits this Bid with the understanding that the Renovation and Addition to the Keystone Regional Youth Center encompassed in the Bidding Documents shall be commenced immediately upon receipt of the Notice to Proceed and shall be fully and finally completed in accordance with the Project schedule established by the Owner, and that time for the completion of the Work shall be considered as of the essence of this Contract, and that for the costs of extra inspections, salaries of contingent forces and other expenses entailed by the Owner by delay in completing the Contract, said Owner shall be entitled to access liquidated damages in the fixed sum of Two Thousand Five Hundred Dollars ($2,500.00), per Contractor, per calendar day, for the first Seven (7) days after the established completion deadline, Five Thousand Dollars ($5,000.00), per Contractor, per calendar day, for the following Seven (7) days, and Seven Thousand Five

Bidder's Handwritten Initials _____

Hundred Dollars ($7,500.00), per Contractor, per calendar day, for each day thereafter until the Date of Substantial Completion as liquidated damages for each and every days' delay, not caused by the Owner. The Owner may, at the Owner's discretion, retain these liquidated damages from any payments due to the Contractor. This provision shall apply to each and every phase of construction.

In addition to the foregoing and without limiting the foregoing, the Contractor and Contractor's Surety shall be jointly and severally liable for and shall pay the Owner the costs incurred by the Owner resulting from the Contractor's delay in submitting Shop Drawings, Product Data, Samples and similar submittals beyond the required number of days specified for such submittals as provided in the Contract Documents as liquidated damages, and not as a penalty, in the amount of Five Hundred Dollars ($500.00) per calendar day, for each calendar day of delay until such submittal has been properly submitted as provided in the Contract Documents. The Owner may, at the Owner's discretion, retain these liquidated damages from any payments due to the Contractor. All submittals shall be received from the Contractors by the earlier of the date set forth in the Contract Documents, if applicable, or within ninety (90) days of the Notice to Proceed.

Bidder understands that the Award of Contract will be preconditioned on submittal to the Owner and the Architect, of a Certificate of Insurance as outlined in the General Conditions, within seven (7) days after notification of Award of Contract is received by this Contractor.

Bidder understands the following supplements to the Bid Form must be submitted concurrent with this bid submission.

Bid Bond Form and Consent of Surety
Substitution List
Non-Collusion Affidavit
Bidder's Qualifications (AIA Document A305, 1986 edition)
Bidder's Qualification Form Supplement
Bidder's Financial Disclosure Form
Sample Certificate of Insurance evidencing limits required herein
Worker Protection and Investment Certification Form BOP-2201
Commonwealth of Pennsylvania Public Works Employment Verification Form for Bidder

Bidder understands the following supplement to the Bid Form must be submitted within seven (7) calendar days after receipt of the Notice of Intent to Award.

Equipment Suppliers List
Subcontractors List

Bidder's Handwritten Initials _____

Employment Verification Form as required by Act No. 127
Performance Bond
Payment Bond
Certificate of Insurance evidencing the limits and including the additional insured language required herein

It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within **(i) five (5) days after the Notice of Intent to Award a Contract submit the Verification Forms required by the Public Works Employment Verification Act on behalf of itself and each of its Subcontractors and (ii)** seven (7) days after notification of Award of Contract, enter into a Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

This Bid is submitted with the definite understanding that Bids are valid for acceptance by the Owner and may not be withdrawn for a period of at least sixty (60) days after the actual date of the opening thereof unless the award of the Contract is delayed due to required approvals of other governmental agencies, or sale of bonds, in which case, Bids shall be irrevocable for one hundred twenty (120) days in compliance with Act 1978-317, approved November 26, 1978.

It is understood that the Owner reserves the right to reject any or all Bids, or part thereof or items therein, and to waive technicalities required for the best interests of the Owner. Omission of any information may be sufficient cause for rejection of this Bid. It is further understood that competency and responsibility of Bidders will receive consideration before the Award of Contract.

The undersigned will not assign his Bid or any of his rights or interests thereunder without the written consent of the Owner.

The Base Bid and other required information are submitted in the spaces provided. Handwritten initials on each page of this Bid Form identify each as a part of this Bid.

BASE BID
The sum of _____Dollars

($_____) for the County of Berks Renovations and Addition to the Keystone Regional Youth Center Project.

ALTERNATES – NOT USED

QUANTITY ALLOWANCES – NOT USED

Bidder's Handwritten Initials _____

UNIT PRICES

The Contractor is required to bid unit prices on the following items as identified below. If any extra Work is required in these categories beyond the Contract requirements, the unit prices shall be used as a basis for determining the amount of additional payment to the Contractor. If any deletions are to be made in these categories, the unit prices shall be used as the basis for determining the credit the Owner is entitled to receive. The Owner reserves the right to reject any unit price which is unreasonable or unbalanced, as compared with prevailing costs, or as compared with the unit prices submitted by the other bidders for this Project. The Owner reserves the right to ask for a revised unit price before or after the Contracts are signed.

Unit Price PC-01: Security Sprinkler Heads $_____/per head

ADDENDA

The Bidder acknowledges receipt of Addenda listed below which have been issued during the bidding period and agrees that said Addenda shall become part of the Contract (Bidder shall list numbers and dates of Addenda received).

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

IDENTIFICATION OF BIDDER

Company _____ Phone_____

Address _____

_____

Please check the appropriate category:

_____ Sole Proprietorship _____ Partnership
_____ Pennsylvania Corporation _____ Foreign Corporation Registered in PA

Bidder's Handwritten Initials _____

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

SIGNATURES

COMPANY NAME

FEDERAL ID#_____

_____

STREET ADDRESS PO BOX CITY STATE ZIP

_____ _____

TELEPHONE # FAX #

Witness or Attest:

_____ _____

An Officer, if Bidder is corporation, if not Owner, Partner, or President/Vice President* corporation, any competent adult

* Bidder to circle appropriate term.

END OF DOCUMENT

Bidder's Handwritten Initials _____

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

BID FORM – HVAC CONSTRUCTION

County of Berks
Controller's Office
Berks County Services Center
633 Court Street, 12th Floor
Reading, PA 19601

DATE
_____

BIDDER
_____

Attn: County Controller

Re: Renovations and Addition to the Keystone Regional Youth Center

The following Bid is submitted in response to your Invitation to Bid.

This Bid is submitted by:

Company Name: _____

Company Address: _____

_____

_____

Main Telephone: _____

Main Fax: _____

Communications and questions concerning this bid are to be directed to:

Contact Name / Title: _____

Contact Telephone: _____

Fax: _____

Contact Email: _____

Bidder's Handwritten Initials _____

In the event our company is awarded a contract as a result of the ITB and this bid, the following individual will serve as project liaison/manager:

Name / Title: _____

Office Address: _____

_____

_____

Telephone: _____

Fax: _____

Email: _____

This Bidder agrees to furnish the bonds required by Article 11, Paragraph 11.4 of the General Conditions, as modified by the Owner. Bid Security in the amount required by the Instructions to Bidders is enclosed. It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within seven (7) days after notification of Award of Contract, enter into a Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

This Bidder has carefully examined the Bidding Documents and the Project site, and certifies that it fully understands the requirements thereof. This Bidder agrees that, after notification of Award of Contract, it will furnish and deliver materials, water, tools, equipment, light, heat, power, tests, transportation, secure permits and licenses, do and perform labor, superintendence and means of construction, pay fees and do incidental Work, and execute, construct and finish the aforesaid in an expeditious, substantial and workmanlike manner, in accordance with the Bidding Documents to the complete satisfaction and acceptance of the Owner for the price hereinafter stated.

As set forth in Article 8, Subparagraph 8.2.4 and Article 9, Subparagraph 9.11 of the General Conditions, Bidder submits this Bid with the understanding that the Renovation and Addition to the Keystone Regional Youth Center encompassed in the Bidding Documents shall be commenced immediately upon receipt of the Notice to Proceed and shall be fully and finally completed in accordance with the Project schedule established by the Owner, and that time for the completion of the Work shall be considered as of the essence of this Contract, and that for the costs of extra inspections, salaries of contingent forces and other expenses entailed by the Owner by delay in completing the Contract, said Owner shall be entitled to access liquidated damages in the fixed sum of Two Thousand Five Hundred Dollars ($2,500.00), per Contractor, per calendar day, for the first Seven (7) days after the established completion deadline, Five Thousand Dollars ($5,000.00), per Contractor, per calendar day, for the following Seven (7) days, and Seven Thousand Five

Bidder's Handwritten Initials _____

Hundred Dollars ($7,500.00), per Contractor, per calendar day, for each day thereafter until the Date of Substantial Completion as liquidated damages for each and every days' delay, not caused by the Owner. The Owner may, at the Owner's discretion, retain these liquidated damages from any payments due to the Contractor. This provision shall apply to each and every phase of construction.

In addition to the foregoing and without limiting the foregoing, the Contractor and Contractor's Surety shall be jointly and severally liable for and shall pay the Owner the costs incurred by the Owner resulting from the Contractor's delay in submitting Shop Drawings, Product Data, Samples and similar submittals beyond the required number of days specified for such submittals as provided in the Contract Documents as liquidated damages, and not as a penalty, in the amount of Five Hundred Dollars ($500.00) per calendar day, for each calendar day of delay until such submittal has been properly submitted as provided in the Contract Documents. The Owner may, at the Owner's discretion, retain these liquidated damages from any payments due to the Contractor. All submittals shall be received from the Contractors by the earlier of the date set forth in the Contract Documents, if applicable, or within ninety (90) days of the Notice to Proceed.

Bidder understands that the Award of Contract will be preconditioned on submittal to the Owner and the Architect, of a Certificate of Insurance as outlined in the General Conditions, within seven (7) days after notification of Award of Contract is received by this Contractor.

Bidder understands the following supplements to the Bid Form must be submitted concurrent with this bid submission.

Bid Bond Form and Consent of Surety
Substitution List
Non-Collusion Affidavit
Bidder's Qualifications (AIA Document A305, 1986 edition)
Bidder's Qualification Form Supplement
Bidder's Financial Disclosure Form
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Worker Protection and Investment Certification Form BOP-2201
Commonwealth of Pennsylvania Public Works Employment Verification Form for Bidder

Bidder understands the following supplement to the Bid Form must be submitted within seven (7) calendar days after receipt of the Notice of Intent to Award.

Equipment Suppliers List
Subcontractors List
Employment Verification Form as required by Act No. 127
Performance Bond
Payment Bond

Bidder's Handwritten Initials _____

Certificate of Insurance evidencing the limits and including the additional insured language required herein

It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within **(i) five (5) days after the Notice of Intent to Award a Contract submit the Verification Forms required by the Public Works Employment Verification Act on behalf of itself and each of its Subcontractors and (ii)** seven (7) days after notification of Award of Contract, enter into a Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

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It is understood that the Owner reserves the right to reject any or all Bids, or part thereof or items therein, and to waive technicalities required for the best interests of the Owner. Omission of any information may be sufficient cause for rejection of this Bid. It is further understood that competency and responsibility of Bidders will receive consideration before the Award of Contract.

The undersigned will not assign his Bid or any of his rights or interests thereunder without the written consent of the Owner.

The Base Bid and other required information are submitted in the spaces provided. Handwritten initials on each page of this Bid Form identify each as a part of this Bid.

BASE BID

The sum of _____Dollars

(includes Allowance listed below)

($_____) for the County of Berks Renovations and Addition to the Keystone Regional Youth Center Project.

ALLOWANCES – See Section 01 21 00

The Bidder Certifies that the aforementioned allowances are INCLUDED in each Bid Amount.

1. Allowance MC1: NRG Controls and Management System Scope of Work (to be issued via Addendum)

Bidder's Handwritten Initials _____

ALTERNATES – NOT USED

UNIT PRICES – NOT USED

ADDENDA

The Bidder acknowledges receipt of Addenda listed below which have been issued during the bidding period and agrees that said Addenda shall become part of the Contract (Bidder shall list numbers and dates of Addenda received).

No. _____	Date _____	No. _____	Date _____
No. _____	Date _____	No. _____	Date _____
No. _____	Date _____	No. _____	Date _____
No. _____	Date _____	No. _____	Date _____
No. _____	Date _____	No. _____	Date _____

IDENTIFICATION OF BIDDER

Company _____ Phone_____

Address _____

_____

Please check the appropriate category:

_____ Sole Proprietorship _____ Partnership
_____ Pennsylvania Corporation _____ Foreign Corporation Registered in PA

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

SIGNATURES

COMPANY NAME

Bidder's Handwritten Initials _____

FEDERAL ID#_____

_____

STREET ADDRESS PO BOX CITY STATE ZIP

_____ _____

TELEPHONE # FAX #

Witness or Attest:

_____ _____

An Officer, if Bidder is corporation, if not Owner, Partner, or President/Vice President* corporation, any competent ad

* Bidder to circle appropriate term.

END OF DOCUMENT

Bidder's Handwritten Initials _____

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

BID FORM – ELECTRICAL CONSTRUCTION

County of Berks
Controller's Office
Berks County Services Center
633 Court Street, 12th Floor
Reading, PA 19601

DATE
_____

BIDDER
_____

Attn: County Controller

Re: Renovations and Addition to the Keystone Regional Youth Center

The following Bid is submitted in response to your Invitation to Bid.

This Bid is submitted by:

Company Name: _____

Company Address: _____

_____

_____

Main Telephone: _____

Main Fax: _____

Communications and questions concerning this bid are to be directed to:

Contact Name / Title: _____

Contact Telephone: _____

Fax: _____

Contact Email: _____

In the event our company is awarded a contract as a result of the ITB and this bid, the following individual will serve as project liaison/manager:

Bidder's Handwritten Initials _____

Name / Title: _____

Office Address: _____

_____

_____

Telephone: _____

Fax: _____

Email: _____

This Bidder agrees to furnish the bonds required by Article 11, Paragraph 11.4 of the General Conditions, as modified by the Owner. Bid Security in the amount required by the Instructions to Bidders is enclosed. It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within seven (7) days after notification of Award of Contract, enter into a Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

This Bidder has carefully examined the Bidding Documents and the Project site, and certifies that it fully understands the requirements thereof. This Bidder agrees that, after notification of Award of Contract, it will furnish and deliver materials, water, tools, equipment, light, heat, power, tests, transportation, secure permits and licenses, do and perform labor, superintendence and means of construction, pay fees and do incidental Work, and execute, construct and finish the aforesaid in an expeditious, substantial and workmanlike manner, in accordance with the Bidding Documents to the complete satisfaction and acceptance of the Owner for the price hereinafter stated.

As set forth in Article 8, Subparagraph 8.2.4 and Article 9, Subparagraph 9.11 of the General Conditions, Bidder submits this Bid with the understanding that the Renovation and Addition to the Keystone Regional Youth Center encompassed in the Bidding Documents shall be commenced immediately upon receipt of the Notice to Proceed and shall be fully and finally completed in accordance with the Project schedule established by the Owner, and that time for the completion of the Work shall be considered as of the essence of this Contract, and that for the costs of extra inspections, salaries of contingent forces and other expenses entailed by the Owner by delay in completing the Contract, said Owner shall be entitled to access liquidated damages in the fixed sum of Two Thousand Five Hundred Dollars ($2,500.00), per Contractor, per calendar day, for the first Seven (7) days after the established completion deadline, Five Thousand Dollars ($5,000.00), per Contractor, per calendar day, for the following Seven (7) days, and Seven Thousand Five Hundred Dollars ($7,500.00), per Contractor, per calendar day, for each day thereafter until the Date of Substantial Completion as liquidated damages for each and every days' delay, not caused by the Owner. The Owner may, at the Owner’s discretion, retain these liquidated damages from any payments due to the Contractor. This provision shall apply to each and every phase of construction.

Bidder's Handwritten Initials _____

In addition to the foregoing and without limiting the foregoing, the Contractor and Contractor's Surety shall be jointly and severally liable for and shall pay the Owner the costs incurred by the Owner resulting from the Contractor's delay in submitting Shop Drawings, Product Data, Samples and similar submittals beyond the required number of days specified for such submittals as provided in the Contract Documents as liquidated damages, and not as a penalty, in the amount of Five Hundred Dollars ($500.00) per calendar day, for each calendar day of delay until such submittal has been properly submitted as provided in the Contract Documents. The Owner may, at the Owner's discretion, retain these liquidated damages from any payments due to the Contractor. All submittals shall be received from the Contractors by the earlier of the date set forth in the Contract Documents, if applicable, or within ninety (90) days of the Notice to Proceed.

Bidder understands that the Award of Contract will be preconditioned on submittal to the Owner and the Architect, of a Certificate of Insurance as outlined in the General Conditions, within seven (7) days after notification of Award of Contract is received by this Contractor.

Bidder understands the following supplements to the Bid Form must be submitted concurrent with this bid submission.

Bid Bond Form and Consent of Surety
Substitution List
Non-Collusion Affidavit
Bidder's Qualifications (AIA Document A305, 1986 edition)
Bidder's Qualification Form Supplement
Bidder's Financial Disclosure Form
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Worker Protection and Investment Certification Form BOP-2201
Commonwealth of Pennsylvania Public Works Employment Verification Form for Bidder

Bidder understands the following supplement to the Bid Form must be submitted within seven (7) calendar days after receipt of the Notice of Intent to Award.

Equipment Suppliers List
Subcontractors List
Employment Verification Form as required by Act No. 127
Performance Bond
Payment Bond
Certificate of Insurance evidencing the limits and including the additional insured language required herein

It is agreed that Bid Security shall be forfeited to the addressee if this Bidder does not, within **(i) five (5) days after the Notice of Intent to Award a Contract submit the Verification Forms required by the Public Works Employment Verification Act on behalf of itself and each of its Subcontractors and (ii)** seven (7) days after notification of Award of Contract, enter into a

Bidder's Handwritten Initials _____

Contract for the construction proposed, furnish the Performance Bond and the Payment Bond required by the Bidding Documents and provide the required insurance.

This Bid is submitted with the definite understanding that Bids are valid for acceptance by the Owner and may not be withdrawn for a period of at least sixty (60) days after the actual date of the opening thereof unless the award of the Contract is delayed due to required approvals of other governmental agencies, or sale of bonds, in which case, Bids shall be irrevocable for one hundred twenty (120) days in compliance with Act 1978-317, approved November 26, 1978.

It is understood that the Owner reserves the right to reject any or all Bids, or part thereof or items therein, and to waive technicalities required for the best interests of the Owner. Omission of any information may be sufficient cause for rejection of this Bid. It is further understood that competency and responsibility of Bidders will receive consideration before the Award of Contract.

The undersigned will not assign his Bid or any of his rights or interests thereunder without the written consent of the Owner.

The Base Bid and other required information are submitted in the spaces provided. Handwritten initials on each page of this Bid Form identify each as a part of this Bid.

BASE BID

The sum of _____Dollars

(includes Allowances listed below)

($_____) for the County of Berks Renovations and Addition to the Keystone Regional Youth Center Project.

ALLOWANCES – See Section 01 21 00

The Bidder Certifies that the aforementioned allowances are INCLUDED in each Bid Amount.

1. Allowance EC1: TWG Access Control Scope of Work (to be issued via Addendum)
2. Allowance EC2: TWG Surveillance Scope of Work (to be issued via Addendum)
3. Allowance EC3: NRG Fire Alarm Scop of Work (to be issued via Addendum)

ALTERNATES – NOT USED

Bidder's Handwritten Initials _____

UNIT PRICES

The Contractor is required to bid unit prices on the following items as identified below. If any extra Work is required in these categories beyond the Contract requirements, the unit prices shall be used as a basis for determining the amount of additional payment to the Contractor. If any deletions are to be made in these categories, the unit prices shall be used as the basis for determining the credit the Owner is entitled to receive. The Owner reserves the right to reject any unit price which is unreasonable or unbalanced, as compared with prevailing costs, or as compared with the unit prices submitted by the other bidders for this Project. The Owner reserves the right to ask for a revised unit price before or after the Contracts are signed.

Unit Price EC-01: Detention Hardware Set #xx **$_____/per set**

Unit Price EC-02: Detention Hardware Set #xx **$_____/per set**

ADDENDA

The Bidder acknowledges receipt of Addenda listed below which have been issued during the bidding period and agrees that said Addenda shall become part of the Contract (Bidder shall list numbers and dates of Addenda received).

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

No. _____ Date _____ No. _____ Date _____

IDENTIFICATION OF BIDDER

Company _____ Phone_____

Address _____

_____

Please check the appropriate category:

_____ Sole Proprietorship _____ Partnership

Bidder's Handwritten Initials _____

_____ Pennsylvania Corporation _____ Foreign Corporation Registered in PA

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

SIGNATURES

COMPANY NAME

FEDERAL ID#_____

_____

STREET ADDRESS PO BOX CITY STATE ZIP

_____ _____

TELEPHONE # FAX #

Witness or Attest:

_____ _____

An Officer, if Bidder is corporation, if not Owner, Partner, or President/Vice President* corporation, any competent ad

* Bidder to circle appropriate term.

END OF DOCUMENT

Bidder's Handwritten Initials _____

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center
BIDDER'S QUALIFICATION FORM SUPPLEMENT

This document is to be used as a supplement to AIA Document A305, 1986 Edition – Contractor's Qualification Statement.

Company Name _____

Amount (In Dollars) of Work Completed Last Year $ _____

Bonding Company _____

Phone _____

Bonding Limit _____

Bidder's Remaining Bonding Capacity _____

Architect/Engineer References (3):

1._____

Phone:_____

2._____

Phone:_____

3._____

Phone:_____

Owner References (3):

1._____

Phone:_____

2._____

Phone:_____

3._____

Phone:_____

List of Projects, Construction Costs, Name, Address and Telephone Number of person to contact for all projects completed in the past calendar year. (If additional space is required, add attachment to this form using the Contractor's own letterhead).

BIDDER'S PAST WORK HISTORY

List similar projects completed in the past three (3) years with the Owner's name, address, phone number and contact person.

PROJECT OWNER/CONTACT PERSON ADDRESS/TELEPHONE NO.

_____

_____

_____

_____

_____

_____

Bidder_____ Phone (___)_____

END OF DOCUMENT

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

BIDDER'S FINANCIAL DISCLOSURE FORM

Company Name _____

Company Address _____

Number of Years in Business _____

In What Commonwealth/State is the Company Licensed to Operate? _____

Has the Company, or any of its Officers, ever defaulted on a Construction Contract? _____

If yes, please explain _____

Has the Company ever been terminated, prior to completion of a Construction Contract? _____

If yes, please explain _____

Has the Company, or any of its Officers, ever been debarred from Public Work? _____

If yes, please explain _____

Has the Company ever terminated a Construction Contract, prior to Completion? _____

If yes, please explain _____

Is the Company presently involved in Litigation? _____

If yes, provide detailed information.

FINANCIAL INSTITUTION REFERENCES:

1. Name _____ Contact _____
   Address _____ Phone _____
2. Name _____ Contact _____
   Address _____ Phone _____
3. Name _____ Contact _____
   Address _____ Phone _____

(On Company letterhead) Attach to this form:

1. Company's Financial Statement for past TWO (2) CALENDAR YEARS.
2. Company's Current Balance Sheet.

END OF DOCUMENT

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

SUBSTITUTION LIST

The following is the list of Alternate/Substitute Equipment or material included within the Bid submitted by:

_____ to
(Bidder)

_____
(Owner)

dated _____ and which is an integral part of the Bid Form.

SPECIFICATION SECTION NO.	COMPONENT DESCRIPTION	SPECIFIED MANUFACTURER	ALTERNATE/ SUBSTITUTE MANUFACTURER

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

EQUIPMENT SUPPLIERS LIST

Herewith is the List of the Suppliers of Equipment to be installed in the Project referenced in the Bid submitted by:

(Bidder)

_____ to

(Owner)

_____

dated _____ and which is an integral part of the Bid Form.

EQUIPMENT COMPONENTS OR ITEMS	SUPPLIER / TELEPHONE NO.
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

SUBCONTRACTORS LIST

Herewith is the List of Subcontractors who will perform the Work on the Project referenced in the Bid submitted by:

(Bidder)

_____ to

(Owner)

_____

dated _____ and which is an integral part of the Bid Form.

The following Work will be performed or provided by the named Subcontractors and coordinated by us:

SECTION OF WORK (SPEC SECTION)	SUBCONTRACTOR / TELEPHONE NO.
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

NON-COLLUSION AFFIDAVIT

CONTRACT NO. _____

Commonwealth of Pennsylvania :
: s.s.
County of _____ :

I state that I am _____ of _____ the Bidder
(Title) (Name of My Company),
that submitted the attached Bid and that I am authorized to make this affidavit on behalf of my company, its owners, directors, and officers. I am the person responsible in my company for the price(s) and the amount of this Bid.

I state that:

(1) The price(s) and amount of this Bid have been arrived at independently and without consultation, communication or agreement by the Bidder, any of its sureties, agents, representatives, owners, employees, or parties in interest with any other contractors, bidders, potential bidders or any other sureties, agents, representatives, owners, employees or parties in interest of any other contractors, bidders or potential bidders. The price(s) quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its sureties, agents, representatives, owners, employees, or parties in interest, including this affidavit.

(2) Neither the price(s) nor the amount of this Bid, and neither the approximate price(s) nor approximate amount of this Bid, have been disclosed to any other company or person who is a bidder, potential bidder or a surety, agent, representative, owner, employee or party in interest of any other contractor, bidder or potential bidder, and they will not be disclosed before opening bid.

(3) No attempt has been made or will be made to induce any company or person to refrain from bidding on this contract, or to submit a Bid higher than this Bid, or to submit any collusive or intentionally high or non-competitive Bid or other form of complementary Bid.

(4) The Bid of my company is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any bidder, potential bidder or a surety, agent, representative, owner, employee or party in interest of any other contractor, bidder or potential bidder to submit a complementary or other non-competitive Bid.

(5)_____, its affiliates, subsidiaries, officers, directors, and
(Name of My Company)
employees are not currently under investigation by any governmental agency and have not in the last three (3) years been convicted or found liable for any act prohibited by State of Federal law

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

I state that _____ understands and acknowledges that the
(Name of My Company)
above representations are material and important, and will be relied on by the County of Berks in awarding the contract(s) for the Renovations and Addition to the Keystone Regional Youth Center for which this Bid is submitted.

I understand and my company understands that any misstatement in this affidavit is and shall be treated as fraudulent concealment from the County of Berks of true facts relating to the submission of Bids for this contract.

_____
(Name and Position in Company)

SWORN TO AND SUBSCRIBED
BEFORE ME THIS ____ DAY
OF _____, 2025

_____
Notary Public
My Commission Expires:

END OF DOCUMENT

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Principal (the "Principal"), and _____, a company organized and existing under the laws of the _____ of _____, with a principal office at _____ _____, and authorized to do business in the Commonwealth of Pennsylvania, as Surety (the "Surety"), are held and firmly bound, unto the COUNTY OF BERKS as Obligee (the "Obligee"), as hereinafter set forth, in the full and just sum of _____ Dollars ($_____) lawful money of the United States of America, for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WITNESSETH THAT:

WHEREAS, the Principal heretofore has submitted to the Obligee a certain Bid, dated _____, 20___ (the "Bid"), to perform _____ Work for the Obligee, in connection with the Renovations and Addition to the Keystone Regional Youth Center located in Bern Township, Berks County, Pennsylvania, pursuant to Drawings, Specifications and other related documents, constituting the Bidding Documents, which are incorporated into the Bid by reference (the "Contract Documents"), as prepared by USA Architects, Planners, and Interior Designers, Ltd.; and

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

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

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

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

NOW, THEREFORE, the terms and conditions of this Payment Bond are and shall be that if the Principal, and if all assignees of the Principal and of any such subcontractor, promptly shall pay or shall cause to be paid, in full, all money which may be due any claimant supplying labor or materials in the prosecution and performance of the Work in accordance with the Contract Documents, including, without limitation, any amendment, extension or addition to the Contract Documents, for material furnished, labor supplied or labor performed, then this Payment Bond shall be void; otherwise, this Payment Bond shall be and shall remain in force and effect.

This Payment Bond, as provided by the Act, shall be solely for the protection of claimants supplying labor or materials to the Principal, any assignees of the Principal, in the prosecution of the Work covered by the Contract Documents, including, without limitation, any amendment, extension or addition to the Contract Documents and is conditioned for the prompt payment of all such materials furnished and labor supplied or performed in the prosecution of any portion of the Work. The term "claimant", when used herein and as required by the Act, shall mean any individual, firm, partnership, association or corporation. The phrase "labor or materials" when used herein and as required by the Act, shall include, without limitation, public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the site of the Work covered by the Contract Documents. As required by the Act, the provisions of this Payment Bond shall be applicable whether or not the material furnished or labor performed enters into and becomes a component part of the public building, public Work or public improvement contemplated by the Contract Documents.

As provided and required by the Act, the Principal and the Surety agree that any claimant, who has performed labor or furnished material in the prosecution of the Work in accordance with the Contract Documents, including, without limitation, any amendment, extension or addition to the Contract Documents, and who has not been paid therefore, in full, before the expiration of ninety (90) days after the day on which such claimant performed the last of such labor or furnished the last of such materials for which payment is claimed, may institute an action upon this Payment Bond, in the name of the claimant, in assumpsit, to recover any amount due the claimant for such labor or material; and may prosecute such action to final judgment and may have execution upon the judgment; provided, however, that: (a) any claimant who has a direct contractual relationship with any subcontractor of the Principal or any assignees of any subcontractor of the Principal, but has no contractual relationship, express or implied, with the Principal, may institute an action upon this Payment Bond only if such claimant first shall have given written notice, served in the manner provided in the Act, to the Principal, within ninety (90) days from the date upon which such claimant performed the last of the labor or furnished the last of the materials for which payment is claimed, stating, with substantial accuracy, the amount claimed and the name of the person for

whom the Work was performed or to whom the material was furnished; and (b) no action upon this Payment Bond shall be commenced after the expiration of one (1) year from the day upon which the last of the labor was performed or material was supplied, for the payment of which such action is instituted by the claimant.

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

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

Provided, that it is expressly agreed that this Payment Bond shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon any amendment to the Contract Documents not increasing the Contract Price in the aggregate by more than twenty percent (20%), so as to bind the Principal and the Surety to the full and faithful performance of the Contract Documents as so amended and the Surety, for value received, does waive notice of any such amendment to the Contract Documents not increasing the Contract Price in the aggregate by more than twenty percent (20%). The term "Amendment", wherever used in this Payment Bond and whether referring to this Payment Bond or the Contract Documents, shall include any alteration, addition, extension or modification, whether material or not, and of any character whatsoever.

Provided, further, that no final settlement between the Obligee and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

In the event that the Obligee incurs legal fees (e.g., fees of attorneys, paralegals and other legal professionals) for default or enforcement of its rights under the Contract Documents or Payment Bond, the Surety agrees to pay for all reasonable legal fees and costs incurred by the Obligee.

Any dispute resolution proceeding, legal or equitable, under this Payment Bond, shall be instituted in the Court of Common Pleas of Berks County and not elsewhere. In such dispute resolution proceeding, Obligee may join both Principal and Surety as parties, and Principal and Surety hereby consent to such joinder, jurisdiction and venue. This Payment Bond shall be governed by, construed and enforced in accordance with the laws of the Commonwealth of Pennsylvania, without regard to principles of conflicts of law.

IN WITNESS WHEREOF, the Principal and the Surety cause this Payment Bond to be signed, sealed and delivered this _____ day of _____, 20___.

(Individual Principal)

_____ (SEAL)
(Signature of Individual)

WITNESS: Trading and Doing Business as

_____ _____

****

(Partnership Principal)

WITNESS: _____
(Name of Partnership)

_____ BY: _____(SEAL)
Partner

_____ BY:_____(SEAL)
Partner

_____ BY:_____(SEAL)
Partner

* * * * * * * * * *

(Corporate Principal)

ATTEST: _____
(Name of Corporation)

_____ BY:_____
Secretary (Assistant Secretary) President (Vice President)

(CORPORATE SEAL)

or (if appropriate)

WITNESS: _____
(Name of Corporation)

_____ *BY:_____
(Authorized Representative)

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

* * * * * * * * * *

(Corporate Surety)

WITNESS:

_____
(Name of Corporation)

_____ **BY:_____
(Attorney-in-Fact)

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

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS that we, _____, as Principal (the "Principal"), and _____, a company organized and existing under the laws of the _____of _____, having its principal office at _____, and authorized to do business in the Commonwealth of Pennsylvania, as Surety (the "Surety"), are held and firmly bound unto the COUNTY OF BERKS as Obligee (the "Obligee"), as hereinafter set forth in the full and just sum of _____ Dollars ($_____), lawful money of the United States of America, for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WITNESSETH THAT:

WHEREAS, the Principal heretofore has submitted to the Obligee a certain Bid, dated _____, 20___ (the "Bid"), to perform _____ Work for the Obligee, in connection with the Renovations and Addition to the Keystone Regional Youth Center located in Bern Township, Berks County, Pennsylvania, pursuant to Drawings, Specifications and other related documents, constituting the Bidding Documents, which are incorporated into the Bid by reference (the "Contract Documents"), as prepared by USA Architects, Planners, + Interior Designers, Ltd.; and

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

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

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

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

NOW, THEREFORE, the terms and conditions of this Performance Bond are and shall be that if: (a) the Principal well, truly and faithfully shall comply with and shall perform the Work in accordance with the Contract Documents, at the time and in the manner provided in the Contract Documents, and if the Principal shall satisfy all claims and demands incurred in or related to the performance of the Contract Documents by the Principal or arising out of the performance of the Contract Documents by the Principal, and if the Principal shall indemnify completely, defend and save harmless the Obligee and all of its officers, agents and employees from any and all costs and damages, including, but not limited to, liquidated damages which the Obligee and all of its officers, agents and employees may sustain or suffer by reason of the failure of the Principal to do so, and if the Principal shall reimburse completely and shall pay to the Obligee any and all costs and expenses which the Obligee and all of its officers, agents and employees may incur by reason of any such default or failure of the Principal, including, but not limited to, legal fees (e.g., fees of attorneys, paralegals and other legal professionals) and professional fees resulting from such default or failure of the Principal, in accordance with the Contract Documents, and (b) if the Principal shall remedy, without cost to the Obligee, all defects which may develop during the period of one (1) year from the date of final completion by the Principal and acceptance of the Obligee of the Work to be performed in accordance with the Contract Documents, which defects, in the sole judgment of the Obligee or its legal successors in interest, shall be caused by or shall result from defective or inferior materials or workmanship, then this Performance Bond shall be void; otherwise, this Performance Bond shall be and shall remain in force and effect and all claims, demands, costs, expenses and damages including, but not limited to, legal fees and professional fees resulting from the default or failure of Principal, in accordance with the Contract Documents, shall be payable by Principal and Surety upon demand of Obligee; provided, however, that the obligations of the Surety hereunder shall not exceed the amount of this Performance Bond, as this Performance Bond is amended, whether automatically or in writing, in accordance with the terms hereof.

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

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

The Principal and the Surety agree that this Performance Bond shall be deemed amended automatically and immediately, without formal and separate amendments hereto, upon any amendment to the Contract Documents not increasing the Contract Price in the aggregate by more than twenty percent (20%), so as to bind the Principal and the Surety to the full and faithful performance of the Contract Documents as so amended and the Surety, for value received, does waive notice of any such amendment to the Contract Documents not increasing the Contract Price in the aggregate by more than twenty percent (20%). The term "Amendment", wherever used in this Performance Bond and whether referring to this Performance Bond or the Contract Documents shall include, without limitation, any alteration, addition, extension or modification of any character whatsoever.

Provided, further, that no final settlement between the Obligee and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

In the event that the Obligee incurs legal fees for default or enforcement of its rights under the Contract Documents or Performance Bond, the Surety agrees to pay for all reasonable legal fees and costs incurred by the Obligee.

Any dispute resolution proceeding, legal or equitable, under this Performance Bond, shall be instituted in the Court of Common Pleas of Berks County and not elsewhere. In such dispute resolution proceeding, Obligee may join both Principal and Surety as parties, and Principal and Surety hereby consent to such joinder, jurisdiction and venue. This Performance Bond shall be governed by, construed and enforced in accordance with the laws of the Commonwealth of Pennsylvania, without regard to principles of conflicts of law.

IN WITNESS WHEREOF, the Principal and the Surety cause this Performance Bond to be signed, sealed and delivered this _____ day of _____, 20___.

(Individual Principal)

_____(SEAL)

WITNESS: (Signature of Individual)

Trading and Doing Business as

_____ _____

* * * * * * * *

(Partnership Principal)

WITNESS: _____
(Name of Partnership)

_____ By:_____(SEAL)
Partner

_____ By:_____(SEAL)
Partner

_____ By:_____(SEAL)
Partner

* * * * * * * *

(Corporate Principal)

ATTEST: _____
(Name of Corporation)

_____ By:_____(SEAL)
Secretary (Assistant Secretary) President (Vice President)

(CORPORATE SEAL)

or (if appropriate)

WITNESS: _____
(Name of Corporation)

_____ *By:_____
(Authorized Representative)

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

* * * * * * * *

(Corporate Surety)

WITNESS: _____
(Name of Corporation)

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

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

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

BID BOND FORM

KNOW ALL MEN BY THESE PRESENTS that we, _____ (hereinafter called the "Principal"), and _____, a company authorized to transact business in the Commonwealth of Pennsylvania, and having its principal office at _____ (hereinafter called the "Surety"), as Surety, are held and firmly bound unto the COUNTY OF BERKS (hereinafter called the "Obligee"), as Obligee, in the sum of _____ Dollars ($_____) lawful money of the United States of America, for payment of which we bind ourselves, and each of our respective heirs, legal representatives, successors and assigns, jointly and severally, by these presents, on this _____day of _____, 20___.

WHEREAS, said Principal is herewith submitting to the Obligee a Bid to perform _____work for the Renovations and Addition to the Keystone Regional Youth Center in Bern Township, Berks County, Pennsylvania, pursuant to Drawings, Specifications, and other Contract Documents incorporated into said Bid by reference; and it is a condition of the Obligee's receipt and consideration of said Bid that such Bid shall be accompanied by Bid Security to be held by the Obligee on terms embodied herein.

THEREFORE, the condition of this obligation is that if said Principal shall, in the event of acceptance of his Bid by Obligee and within the period specified therefor in the Contract Documents, furnish a Performance Bond and a Payment Bond to the Obligee with good and sufficient surety or sureties, as may be required for the faithful performance and proper fulfillment of the Contract, in the form specified by the Owner, and furnish required certificates of insurance, and shall enter into such Contract in all respects as required by the Contract Documents, then this obligation shall be void and of no effect, but otherwise it shall remain in full force. In the event of the failure to enter into such Contract, furnish such bonds, and furnish such certificates of insurance within the time specified, the Principal and Surety shall pay to the Obligee the difference between the amount of the Principal's accepted Bid and any higher amount for which the Obligee may contract for the required work, as well as any advertising, architectural fees, legal fees (e.g., fees of attorneys, paralegals and other legal professionals) and other costs and expenses incurred by the Obligee by reason of the default; provided, however,

that the obligations of the Surety hereunder shall not exceed the amount of this Bid Security together with interest.

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

(Individual Principal) _____(SEAL)
(Signature of Individual)

Witness: Trading and Doing Business as:

_____ _____

(Partnership Principal) _____
(Name of Partnership)

Witness:

_____ By:_____(SEAL)

_____ By:_____(SEAL)

(Corporation Principal) _____
(Name of Corporation)

Attest:_____ By:_____
(Asst.) Secretary (Vice) President

(CORPORATE SEAL)

OR (if applicable)

Attest:_____ *By:_____
Authorized Representative

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

(Corporate Surety) _____
(Name of Surety)

Witness or Attest:

_____ **By:_____
(CORPORATE SEAL) Title

**Attach an appropriate Power of Attorney, dated as of the same date as this Bid Bond, evidencing the authority of the Attorney-in-Fact to act on behalf of the Surety.

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

CERTIFICATE AS TO CORPORATE PRINCIPAL

I, _____ certify that I am the _____ of the Corporation named as PRINCIPAL, in the within Bid Bond; that _____ who signed the said Bid Bond on behalf of the Principal was then _____ of said Corporation; that I know the signee's signature, and the signature thereto is genuine; and that said Bid Bond is duly signed, sealed and attested for on behalf of said Corporation by authority of its governing body.

_____ (SEAL)
(Secretary)

COUNTY OF BERKS
Renovations and Addition to the Keystone Regional Youth Center

AGREEMENT OF SURETY

(Note: This Agreement shall be properly executed and must accompany the Certified Check, Bank Cashier's Check, Trust Company Treasurer's Check or Bid Bond, whichever is furnished as Bid Security.)

KNOW ALL MEN BY THESE PRESENTS, that we _____, as Surety, a corporation existing under the laws of the State of _____, and authorized to transact business in the Commonwealth of Pennsylvania, hereby agree to execute within the time limit specified in the Contract Documents, the Performance Bond and Payment Bond in the forms and in the amounts required for the faithful performance and proper fulfillment of the _____ Construction Contract for the **Renovations and Addition to the Keystone Regional Youth Center** on behalf of

_____
(Name of Contractor)

hereinafter called the Bidder, provided that the above Contract be awarded to the Bidder within sixty (60) days after the date of opening of Bids or otherwise as set forth in the Instructions to Bidders, and the Surety further agrees that should the Surety, after notification of intent to make such award, omit or refuse to execute the required bonds, then the Surety shall pay to the Obligee the difference between the amount of the Principal's accepted Bid and any higher amount for which the Obligee may contract for the required work, as well as any advertising, Architect's, legal and other expenses incurred by the Obligee by reason of the default; provided, however, that the obligations of the Surety hereunder shall not exceed the amount of this Bid Security together with interest.

_____ _____
WITNESS CORPORATE SURETY

_____ _____(Affix
DATE SIGNATURE Corporate Seal)

_____
ATTORNEY-IN-FACT

DRAFT

AIA® Document A305™ – 1986

Contractor's Qualification Statement

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

SUBMITTED TO:

ADDRESS:

SUBMITTED BY:

NAME:

ADDRESS:

PRINCIPAL OFFICE:

[ ] Corporation
[ ] Partnership
[ ] Individual
[ ] Joint Venture
[ ] Other

NAME OF PROJECT *(if applicable)*:

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

[ ] General Construction
[ ] HVAC
[ ] Electrical
[ ] Plumbing
[ ] Other (please specify)

§ 1. ORGANIZATION

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

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

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

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

§ 1.3.1 Date of incorporation:
§ 1.3.2 State of incorporation:
§ 1.3.3 President's name:
§ 1.3.4 Vice-president's name(s)

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.

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

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User Notes: (1570772790)

§ 1.3.5 Secretary's name:
§ 1.3.6 Treasurer's name:

§ 1.4 If your organization is a partnership, answer the following:
§ 1.4.1 Date of organization:
§ 1.4.2 Type of partnership (if applicable):
§ 1.4.3 Name(s) of general partner(s)

§ 1.5 If your organization is individually owned, answer the following:
§ 1.5.1 Date of organization:
§ 1.5.2 Name of owner:

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

§ 2. LICENSING

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

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

§ 3. EXPERIENCE

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

§ 3.2 Claims and Suits. (If the answer to any of the questions below is yes, please attach details.)
§ 3.2.1 Has your organization ever failed to complete any work awarded to it?

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

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

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

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

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

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

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

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

§ 4. REFERENCES

§ 4.1 Trade References:

§ 4.2 Bank References:

§ 4.3 Surety:

§ 4.3.1 Name of bonding company:

§ 4.3.2 Name and address of agent:

§ 5. FINANCING

§ 5.1 Financial Statement.

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

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

Net Fixed Assets;

Other Assets;

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

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

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

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

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

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

§ 6. SIGNATURE

§ 6.1 Dated at this day of

Name of Organization:

By:

Title:

§ 6.2

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

Subscribed and sworn before me this day of 20

Notary Public:

My Commission Expires:

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General Conditions of the Contract for Construction

for the following PROJECT:

THE OWNER:

County of Berks
Services Center Building, 16th Floor
633 Court Street
Reading, PA 19601

THE ARCHITECT:
(Name, legal status and address)

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.

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

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DRAFT

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. The Contract Documents shall include Bidding Documents, including but not limited to, Invitation to Bid, Instructions to Bidders, the Contractor's Bid Form, Bid Bond, Performance Bond, Payment Bond, Non-Collusion Affidavit and Addenda or portions of the Addenda relating to any Bidding Documents. The Contract Documents shall apply to all Prime Contracts and each Prime Contractor is responsible for the content of all.

§ 1.1.2 THE CONTRACT

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

§ 1.1.2.1 Each Contractor acknowledges and warrants that it has closely examined all of the Contract Documents, that they are suitable and sufficient to enable the Contractor to complete the Work in a timely manner for the Contract Sum, and that they include all Work, whether or not shown or described which reasonably may be inferred to be required or useful for the completion of the Work in full compliance with all applicable standards, codes, laws, ordinances, regulations and/or requirements of any state, federal or other governmental agency.

§ 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.

§ 1.1.3.1 The Work shall include, without limitation, the obligation of the Contractor to visit the site of the Project before submitting a Bid. Such site visit shall be for the purpose of familiarizing the Contractor with the conditions as they exist and the character of the operations to be carried on under the Contract Documents, including, without limitation, all existing site conditions, access to the site, physical characteristics of the site and surrounding areas.

§ 1.1.3.2 Nothing in these General Conditions shall be interpreted as imposing on either the Owner, Architect, or their respective agents, employees, officers, directors or consultants, any duty, obligations or authority with respect to any items that are not intended to be incorporated into the completed Project, or that do not comprise the Work including, but not limited to, the following: shoring; scaffolding; hoists; weatherproofing; or any temporary facility; or activity; since these are the sole responsibility of each Contractor.

§ 1.1.4 THE PROJECT

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

§ 1.1.5 THE DRAWINGS

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

§ 1.1.5.1 The Drawings are diagrammatical and show the general arrangement and extent of the Work: exact locations and arrangements of parts shall be determined as the Work progresses and shall be subject to the Architect's approval. No extra compensation will be allowed due to conflicts, inconsistencies, or discrepancies between actual dimensions and those indicated. The right is reserved by the Architect to make any reasonable

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change in location of equipment, ductwork and piping, prior to roughing in without involving additional expense. Each Prime Contractor shall coordinate its Work with the Work of others, so that interference between trades does not occur. Each Prime Contractor shall furnish and install offsets, bends, turns, and the like in connection with its Work to avoid interference with Work of other Contractors, to conceal Work where required, and to secure necessary clearance and access for operation and maintenance.

§ 1.1.6 THE SPECIFICATIONS

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

§ 1.1.7 INSTRUMENTS OF SERVICE

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

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. In the event that the Architect serves the role of the Initial Decision Maker, the Architect shall receive no additional compensation for such services.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

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

§ 1.2.1.1 Measurement - Before ordering any materials or doing any Work, each Contractor and each Subcontractor shall verify measurements at the Project site and shall be responsible for the correctness of such measurements. No extra charge or compensation will be allowed on account of differences between actual dimensions and the dimensions indicated on the Drawings. Any difference which may be found shall be submitted to the Architect for resolution before proceeding with the Work.

§ 1.2.1.2 If a minor change in the Work is found necessary due to actual field conditions, each Contractor shall submit detailed drawings of such departure for the approval by the Architect before making the change.

§ 1.2.1.3 Notwithstanding anything else to the contrary in the Contract Documents, in the event of conflicts, inconsistencies or discrepancies between and/or within the Contract Documents and/or applicable standards, codes, laws, ordinances, regulations and/or requirements of any state, federal or any other governmental agency, the Contractor shall (1) provide the better quality or greater quantity of Work or (2) comply with the more stringent requirement, or both, in accordance with the Architect's interpretation. The terms and conditions of this Paragraph, however, shall not relieve the Contractor of any of the obligations set forth in Paragraphs 3.2 and 3.7 and their Subparagraphs.

§ 1.2.1.4 In the event of conflicts, inconsistencies, or discrepancies among the Contract Documents, interpretations will be based on the following order of precedence:

- **.1** The Agreement;
- **.2** Addenda, those of later date have precedence;
- **.3** General Conditions;
- **.4** General Requirements;
- **.5** Large-scale Drawings shall supersede smaller-scale Drawings;
- **.6** Dimensions shall govern over scaling of the Drawings;
- **.7** In case of conflicts, inconsistencies, or discrepancies in the Drawings or in the Specifications, the latter shall be submitted to the Architect who will promptly make a determination in writing.

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

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

§ 1.2.3.1 Except as defined in Subparagraph 1.2.3.2, for the purpose of this Project, the meaning of all words, shall be in accordance with the definitions given in "The Random House Dictionary of the English Language, Second Edition, Unabridged, copyright 1987."

§ 1.2.3.2 Certain terms used in Contract Documents are defined in this Article. Definitions and explanations of this Article are not necessarily either complete or exclusive, but are general for the Work to the extent they are not stated more explicitly in other provisions of the Contract Documents. These terms are:

.1 Indicated: The term "indicated" is a cross-reference to graphics, notes or schedules on Drawings, to other paragraphs or schedules in the Specifications, and to similar means of recording requirements in Contract Documents. Where terms such as "shown", "noted", "scheduled", and "specified" are used in lieu of "indicated," it is for purpose of helping the reader locate a cross-reference, and no limitation of location is intended except as specifically noted.

.2 Directed, Requested, Etc.: Where not otherwise explained, terms such as "directed," "requested," "authorized," "selected," "approved," "required," "accepted" and "permitted" mean "directed by the Architect, after consultation with the Owner." However, no such implied meaning will be interpreted to extend the Architect's responsibility into each Contractor's area of construction supervision.

.3 Approved: Where used in conjunction with Architect's response to submittals, requests, applications, inquiries, reports and claims by a Contractor, the term "Approved" will be held to limit the Architect's responsibilities and duties as specified in these General Conditions. In no case will "Approved" by the Architect be interpreted as a release of Contractor from responsibilities to fulfill requirements of Contract Documents.

.4 Furnish: Except as otherwise defined in greater detail, the term "furnish" is used to mean supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations, as applicable in each instance.

.5 Install: Except as otherwise defined in greater detail, the term "install" is used to describe operations at the Project site including, but not limited to, unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, including, without limitation, the coordination with other Contractors and Subcontractors as applicable in each instance.

.6 Relocate: The term "relocate" shall mean "move from the existing location to the new location installed complete and ready for use" all items noted on the Drawings and/or indicated in the Specifications.

.7 Provide: Except as otherwise defined in greater detail, the term "provide" means furnish and install, complete and ready for intended use, as applicable in each instance.

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

.9 Verify: The term "verify" means to measure, investigate, review, test, and check the accuracy or correctness of and prove by demonstration, evidence, or testimony, the location, size, dimension, and condition of an item.

.10 Regulations: The term "Regulations" includes, without limitation, laws, statutes, ordinances and lawful orders issued by authorities having jurisdiction, as well as rules, conventions and agreements within the construction industry that control performance of the Work, whether they are lawfully imposed by authorities having jurisdiction or not.

.11 Installer: The term an "Installer" is an entity engaged by a Contractor, either as an employee, Subcontractor or Sub-Subcontractor for performance of a particular construction activity, including, but not limited to, installation, erection, application and similar operations. Installer is required to be experienced in the operations it is engaged to perform. The term "experienced," when used with the term "Installer" means having a minimum of five (5) years of previous Project experience similar in size and scope to this Project, and familiar with the precautions required, and has complied with

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requirements of the authority having jurisdiction.

.12 Contract Description: The term "Contract Description" means a list of specification sections, narrative, and Contract Document references that will be the responsibility of that specific Prime Contractor.

.13 Prime Contractor: The term "Prime Contractor" means a Contractor who will have a Contract to perform a specific Contract description referred to as Prime Contractor or just Contractor.

.14 Architect/Engineer: The term "Architect/Engineer" means the registered Architect of record.

.15 "Agreement" and "Contract" may be used interchangeably.

.16 "Project Coordinator" means the General Contractor.

.17 "Dispute" means any disagreement between two parties to the Contract Documents, including, without limitation, a disagreement relating to the obligations of the Contractor under the Contract Documents, a disagreement relating to the interpretation of the Contract Documents or any disagreement arising out of or relating to the Contract Documents.

§ 1.2.4 Where the Work is shown in complete detail on only a portion of the Drawings or there is an indication of continuation, the remainder being shown in outline, the Work drawn out in detail shall be understood to apply to the other portions of the structure. The Drawings and Specifications are intended to be a common set of documents. Anything shown in the Drawings but not in Specifications shall be equally binding as if both noted on the Drawings and called for in the Specifications.

§ 1.2.5 No measurement of a drawing by scale shall be used as working dimension. Working measurements shall be taken from figure dimensions.

§ 1.2.6 Each Contractor shall carefully examine the civil, architectural, plumbing, electrical, fire protection drawings and other Contract Drawings and Specifications. If any conflicts, inconsistencies, or discrepancies occur between and/or within the Drawings and Specifications, the Contractor shall promptly report such a conflict, inconsistency, or discrepancy to the Architect in writing and obtain written instructions as to the manner in which to proceed. If not clarified by Addendum, Contractor shall provide the better quality or greater quantity of Work in accordance with the Architect's interpretation. No departures from the Contract Documents shall be made without the prior written approval of the Architect and written notice to the Owner.

§ 1.2.7 In the event that such conflicts, inconsistencies or discrepancies are not reported and a difference in quantity or quality is concerned, then, the Architect will make a selection, based on its sole judgment. No additional compensation or extension of time will be allowed.

§ 1.2.8 Each Contractor represents that the Subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations.

§ 1.2.8.1 Sections of Division 01 – General Requirements govern the execution of all sections of the Specifications.

§ 1.2.9 The Contractor shall not be relieved of responsibility for any Work by showing that a separate contractor has, or should have, responsibility for the same portion of the Work. Disputes concerning who, as between the Contractor and a separate contractor, must perform a particular aspect of the Work or comply with a particular requirement shall be determined by the Architect, whose decision shall be final and binding upon the Contractor and, if so provided in the separate contractor's contract for construction, upon the separate contractor. If the Architect decides that the particular aspect or requirement is within the scope of Work of both the Contractor and a separate Contractor, the Architect shall decide which shall perform the Work and which shall give the Owner a credit to the Contract Sum for omitting the Work.

§ 1.3 CAPITALIZATION

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

§ 1.4 INTERPRETATION

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

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§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

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

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

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

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.2 The Owner shall not be responsible for furnishing surveys (unless required for the execution of the Work and requested by the Contractor in writing) or other information as to the physical characteristics of, legal limitations of or utility locations for the Project site, but shall furnish or cause to be furnished to the Contractor a legal description of the Project site, which shall not constitute one of the Contract Documents. The Contractor shall confirm the location of each utility, shall excavate and dispose of each on-site utility and shall cap each off-site utility as required by the Work and as may be included in the Specifications. To the extent required for the execution of the Work, the Owner shall only provide to the Contractor such test borings and information that it has as to subsurface conditions and site geology. This data shall not constitute one of the Contract Documents. Owner does not assume any responsibility whatsoever with respect to the sufficiency or accuracy of borings made, or of the logs of test borings, or of other investigations, or of the interpretations made thereof, and there is no warranty or guaranty, express or implied, that the conditions indicated by such investigations, borings, logs or information are representative of those existing throughout the Project site, or any part thereof, or that unforeseen developments may not occur. The Contractor represents that it is familiar with the Project site and has received all information it needs concerning the condition of the Project site. The Contractor represents that it has inspected the location of the Work and has satisfied itself as to the condition thereof, including, but not limited to, all structural, surface and reasonably ascertainable subsurface conditions. Based upon the foregoing inspections, understandings, agreements and acknowledgments, the Contractor agrees and acknowledges: (1) that the Contract Sum is just and reasonable compensation for all Work, including, without limitation, foreseen and foreseeable risks, hazards and difficulties in connection therewith, and (2) that the Contract Time is adequate for the performance of the Work. The Contractor shall have no claims for surface or reasonably ascertainable subsurface conditions encountered. The Contractor shall exercise special care in executing subsurface Work in proximity of known subsurface utilities, improvements, and easements.

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

§ **2.2.4** The Contractor will be furnished with digital copies of drawings. The Contractor is responsible for printing sets or individual sheets.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. The right shall be in addition to and not in restriction or derogation of the Owner's rights under Article 14 hereof. The Owner's right to stop the Work shall not relieve the Contractor of any of its responsibilities and obligations under or pursuant to the Contract Documents.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven (7) 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, 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 reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. The right of the Owner to stop the Work pursuant to this Paragraph 2.4 shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity. The Owner's rights set forth in Paragraph 2.3 and 2.4 hereof shall be in addition to all other rights of the Owner granted in the Contract Documents, at law, or in equity.

§ 2.5 In no event shall the Owner and Architect have control over, charge of, or any responsibility for construction means, methods, techniques, sequences or procedures or for safety precautions and programs in connection with the Work, notwithstanding any of the rights and authority granted the Owner in the Contract Documents. Hence, the Owner and Contractor hereby acknowledge and agree that the Owner has retained the Contractor as an independent contractor to perform the Work on the Project. It is expressly understood and agreed that the presence on the jobsite of the Owner's visiting officers or employees, the Owner, Architect or supervisory personnel employed by Owner and the making by such personnel of any inspections of the Contractor's Work, materials, tools or equipment, or of the finished Work of the Contractor and their approval of same, or failure to take exception thereto, shall in no way relieve the Contractor from its absolute responsibility to perform its Work and furnish its materials in accord with the requirements of the Contract Documents. It is further understood that under no circumstances shall the Contractor urge, for any purpose whatsoever, that the presence of the Owner, Architect, any supervisory personnel, and visiting officers or employees of the Owner or Architect and any failure by such personnel to take exception to any Work of the Contractor, constitutes a ratification or approval of the Work or work methods employed by the Contractor if the same did not in fact comply with the requirements of the Contract Documents.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

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

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

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§ 3.1.3 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 Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

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

§ 3.2.2 Each Contractor shall carefully study and compare the Drawings, the Specifications, Addenda and other Contract Documents relative to the Work, the Work, shall take field measurements of any existing conditions related to the Work and shall observe any conditions at the Project site affecting the Work. Any design errors, inconsistencies or omissions noted by a Contractor shall be reported promptly to the Architect. Each Contractor acknowledges that the Contract Documents are full and complete, are sufficient to have enabled it to determine the Contract Sum and that the Drawings, the Specifications and all Addenda are sufficient to enable such Contractor to construct the Work outlined therein in accordance with applicable laws, statutes, ordinances, codes, building codes and regulations of any state, federal or any other governmental agency, and otherwise to fulfill all of its obligations under the Contract Documents.

§ 3.2.2.1 Except as to any reported errors, inconsistencies or omissions, and to concealed or unknown conditions defined in Paragraph 3.7.4 by executing the Agreement, the Contractor represents the following:

.1 The Contract Documents are sufficiently complete and detailed for the Contractor to: (1) perform the Work required and to produce the results intended by the Contract Documents; and (2) comply with all requirements of the Contract Documents.

.2 The Work required by the Contract Documents, including, but not limited to, all construction details, construction means, methods, procedures, and techniques necessary to perform the Work, use of materials, selection of equipment, and requirements of product manufacturers are consistent with: (1) good and sound practices within the construction industry; (2) generally prevailing and accepted industry standards applicable to Work; (3) requirements of any warranties applicable to the Work; and (4) all laws, statutes, ordinances, regulations, rules, orders, codes, and building codes of any state, federal or any other governmental agency which bear upon each Contractor's performance of the Work.

§ 3.2.3 Each Contractor shall, therefore, satisfy itself as to the accuracy of all dimensions and locations. In all cases of interconnection of its Work with existing or other Work, it shall verify at the site, all dimensions relating to such existing or other Work. Any errors due to the Contractor's failure to verify all such locations or dimensions shall be promptly rectified by the Contractor without any additional cost to the Owner.

§ 3.2.4 If the Contractor believes that additional time is involved because of clarifications or instructions issued by the Architect in response to the Contractor's notices or requests for information pursuant to the Contract Documents, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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§ 3.3.1.1 Each Contractor is to appoint a superintendent on site and will designate the same in writing, who has the authority to act on behalf of the Contractor and its Subcontractors and suppliers.

§ 3.3.1.2 At any time during the Project, the Owner and Architect shall have the right, and the authority, but not the duty, to require the replacement of the Contractor's Project Manager, Superintendent or Foreman. The Owner and the Architect shall have the right, and the authority, but not the duty, to require the Contractor to assign additional supervisory personnel to the Project to ensure compliance with the schedule and quality requirements at no additional cost to the Owner and no increase in the Contract Sum. The Contractor shall not change or replace the assigned Project Manager without the prior written consent of the Owner.

§ 3.3.1.3 When more than one major phase is being constructed at different locations of the Project site, supervision must be assigned to each phase when Work under the Contract is being performed. When performing construction Work to maintain the progress schedule requires extended hours, multiple shifts, and/or additional work days, adequate supervision shall be required of each Contractor during these times. The competence level and ability of supervisory personnel must be adequate to perform the construction activities involved.

§ 3.3.1.4 Although these various second level supervision personnel may be reassigned from time to time, the Contractor shall retain one superintendent with full responsibility while performing Work on the Project.

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

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

§ 3.3.4 After Award of Contract, any claims for additional costs associated with completion of the Work within the required Contract Time will not be considered. Contractors, who feel extra time, in any form, such as shift work, overtime, and premium time, is necessary to meet Contract requirements regardless of trade, should include these costs in their Bid. Contractors must recognize that, although its Work might not require shift, overtime, or premium time work for completion within the stipulated time frame, it may be required in order to allow other Contractors to complete their Work within the Contract Time. The Contractor must allow for these shift, overtime, and premium time requirements and include the costs necessary to allow the other Contractors to complete the Work within the specified time. Failure to recognize the extra costs in its Bid shall not relieve the Contractor from utilizing shift, overtime, or premium time work in performance of its Contract nor entitle the Contractor to additional compensation. Where installation work is part of the Contract, all costs associated with meeting the time frames indicated in the construction schedules shall be included in the Contract Sum and the Owner shall incur no additional cost and there shall be no increase in the Contract Sum.

§ 3.3.5 No alleged verbal agreement or conversation with any officer, agent or employee of the Owner or Architect, either before or after the execution of the Contract, shall affect or modify the terms or obligations herein contained. Failure to comply with any or all of the above requirements will not relieve the Contractor from the responsibility of properly estimating the difficulty or cost of successful completion of the Work, nor from the responsibility for the faithful performance of the provisions of this Contract. Modifications or changes may be made in writing only. This requirement may not be waived under any circumstances.

§ 3.3.6 The Contractor has reviewed the completion dates and times set forth in the Contract Documents, agrees that such dates and times are reasonable and commits to achieve them. The Contract Sum includes costs associated with completion by those dates and times, including, but not limited to, costs associated with out-of-sequence work, come-back work, stand-by work, stacking of trades, coordination with the schedules and work of separate contractors, allowing sufficient time, work and storage areas, and site access for separate contractors to timely progress and complete their work, overtime, expediting and acceleration that may be required to complete the Work by those dates and times.

§ 3.3.6.1 Contractors whose failure to perform their Work or whose negligence in performing their Work impacts other Contractors, Subcontractors and/or Sub-Subcontractors shall be responsible for damages incurred by the other Contractors, Subcontractors and the Sub-Subcontractors that are necessary to maintain the Project schedules.

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§ 3.3.7 The General Contractor is designated as the Project Coordinator for this Project. The Project Coordinator and other Prime Contractors are responsible for coordination of the Work. The Project Coordinator is responsible for making all coordination decisions not mutually agreed to by all affected Prime Contractors. Disputes between or among the Project Coordinator and one or more other Prime Contractors and disputes in connection with the construction schedule, the furnishing of additional resources to meet the project schedule, job coordination and all aspects of the means and methods of construction shall be submitted promptly to the Project Coordinator for a final construction decision. The Project Coordinator and the affected Prime Contractor or Contractors shall in connection with all submissions for a final construction decision provide actual written notice contemporaneously to the Architect and the Owner. The final construction decision of the Project Coordinator must, at all times, be consistent with content and intent of the Contract Documents and the latest accepted schedule. The final construction decision of the Project Coordinator will be observed, accepted and fully followed by all Prime Contractors and their Subcontractors on the project, subject only to the dispute resolution procedures set forth in Paragraph 6.2.5 and its subparagraphs of these General Conditions. The progress of the Work in accordance with the final construction decision of the Project Coordinator shall not be delayed pending any such dispute resolution proceedings.

§ 3.4 LABOR AND MATERIALS

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

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

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

§ 3.4.3.1 COMPETENT WORKMEN: No person shall be employed to do Work under such Contract except competent and first class workmen and mechanics. No workmen shall be regarded as competent and first class except those who are duly skilled in their respective branches of labor, and who shall be paid not less than such rates of wages and for such hours' of work as shall be established and current rates of wages paid for such hours by employers of organized labor in doing of similar work in the location where the Work is being done. The Contractor shall not employ workers, means, materials or equipment which may cause strikes, work stoppages or any disturbances by workers employed by the Contractor or the Owner or other Contractors or Subcontractors in connection with the Work of the Project or the location thereof. The Contractor agrees that all disputes as to jurisdiction of trades shall be adjusted in accordance with any plan for the settlement of jurisdictional disputes which may be in effect either nationally or in the locality in which the Work is being performed and that it shall be bound and abided by such adjustments and settlements of jurisdictional disputes, provided that the provisions of this Article shall not be in violation of or in conflict with any provisions of law applicable to the settlement of such disputes. Should the Contractor fail to carry out or comply with any of the foregoing provisions, the Owner shall have the right, in addition to any other rights and remedies provided by the Contract Documents, at law or at equity, after three (3) days' written notice mailed or delivered to the last known address of the Contractor, for all or any portion of the Work, and, for the purpose of completing the Work, to enter upon the premises and take possession, in the same manner, to the same extent and upon the same terms and conditions as set forth in Paragraph 14.2.

§ 3.4.4 In the event of a dispute between the Contractor and the Owner, to the extent that the Owner incurs any legal fees (e.g., fees of attorneys, paralegals and other legal professionals, etc.), professional fees (e.g., architectural or engineering fees, construction management fees and consulting fees, etc.), or other costs or expenses, the Contractor will be responsible for those amounts, which will be deducted, to the extent available, from any amount due the Contractor. If the amount due the Contractor is not sufficient to cover such cost, the Contractor shall pay the difference to the Owner within seven (7) days of receipt of the Owner's invoice for such legal fees, professional fees or other cost or expenses.

§ 3.4.5 The Contractor shall remove from the Project such employees of the Contractor or of any Subcontractor as

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the Owner requests be removed, with or without a reason. The Contractor shall require the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor to comply with the following requirements:

.1 Socializing with the building occupants, visitors or patrons is prohibited.

.2 Smoking, consumption and all other uses of tobacco and alcoholic beverages is prohibited in buildings owned by or under the control of the Owner. Contractors and their employees working on the Project are similarly prohibited from smoking in the building.

.3 Unless otherwise open and available to the public, using the building facilities, e.g., lunchroom, toilets, etc. is prohibited.

.4 Making any remarks to passing individuals that violate decency or cause embarrassment to that individual or the Owner is prohibited.

.5 Failing to comply with the above requirements will result in the Owner removing the offending party permanently from the Project.

§ 3.4.6 The Contractor in making or ordering material shipments shall not consign or have consigned materials, equipment or any other items in the name of the Owner. The Owner shall not be under any obligation to make payment for charges on shipments made by or to the Contractor but may, at its option, pay such charges in which case the Contractor shall reimburse the Owner for the amount of such payments plus a service charge of twenty-five percent (25%) of the amount so paid.

§ 3.4.7 After the Agreement has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 01 of the Specifications, Section "Product Requirements").

§ 3.4.8 By making requests for substitutions based on Paragraph 3.4.7 the Contractor:

.1 Represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.

.2 Represents that the Contractor will provide the same warranty for the substituted product that the Contractor would for that specified.

.3 Certifies that the cost data presented is complete and includes all related costs under this Agreement except the Architect's redesign costs and waives all claims for additional cost related to the substitution which subsequently become apparent.

.4 Represents that it will coordinate the installation of the accepted substitute product and make such changes as may be required for the Work to be complete in all respects.

.5 Represents that, in the event incorporation of a substituted item or assembly into the Work will require revisions or additions to the Work of other construction contracts, the Contractor proposing to use such substituted materials, products, or assembly will bear the cost of such revisions or additions at no change in the Contract Sum.

§ 3.4.9 STANDARD OF QUALITY: The various materials and products specified in the Specifications by name or description are given to establish a standard of quality and of cost for bid purposes. It is not the intent to limit the Bidder to any one material or product specified but rather to describe the minimum standard. When proprietary names are used, they shall be followed by the words "or alternates of the quality necessary to meet the Specifications." A Bid containing an alternate which does not meet the Specifications may be declared non-responsive. A Bid containing an alternate may be accepted but, if an award is made to that Bidder, the Bidder will be required to replace any alternates which do not meet the Specifications. Where products or manufacturers are listed with the words "No Substitutions" or approved substitutions "None", these items are proprietary and the sole acceptable source for this Project, and no substitutions will be permitted.

§ 3.4.10 The Contractor shall require its employees and agents, and its Subcontractor's employees and agents to work diligently and behave in an orderly manner at all times when at or about the Project and shall remove from the Project any employee whose conduct is deemed objectionable.

§ 3.4.11 CONTRACT SUM NOT ADJUSTED FOR RISING COSTS: The Bid for each Contract must be guaranteed for the duration of this Project, and shall thereby have incorporated within it any or all escalation factors related to market conditions. Notwithstanding any other provision in the Contract Documents to the contrary, each Contractor's Contract Sum is intended to include all increases in cost, foreseen or unforeseen, including, without limitation, increases in costs arising from supply shortages, unusual delay in deliveries, increases in market prices for materials,

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labor, taxes and/or other causes beyond the Owner's control, all of which are to be borne solely by the applicable Contractor supplying the materials and/or labor to the Project. All loss and/or damage arising from any of the Work performed under this Agreement through unforeseen or unusual obstructions, difficulties or delays which may be encountered in the prosecution of same shall be borne solely by the applicable Contractor prosecuting the Work.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects in the quality of the Work. Work, materials, or equipment 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, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.1 Materials and workmanship shall be guaranteed for a minimum of one (1) year from the Date of Substantial Completion of the entire Project, except where a longer period is specified, and the Contractor shall make good without cost to the Owner for any defective portion of the Work of which the Contractor is notified within one (1) year of the date of final payment of Contract. Repair or replacement of such defects shall extend to other Work damaged thereby. Owner's rights and remedies hereunder shall be in addition to any other rights and remedies which the Owner may have pursuant to law, equity or the Contract Documents. If the Contractor fails to adhere to this provision, the Owner will be entitled to, in seeking to enforce its rights, recover legal fees, or any other expenses.

§ 3.5.2 The Contractor shall forward guarantee and warranty registration cards to the manufacturers in the name of the Owner showing the date of acceptable Substantial Completion of the Work as the beginning date for guarantee and warranty periods.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work.

§ 3.6.1 The Contractor hereby accepts and assumes full and exclusive liability for payment of all sales taxes, state and municipal taxes including, without limitation, business privilege taxes, use taxes, and all contributions and payroll taxes under the provisions of Federal law or the laws of the Commonwealth of Pennsylvania, including, but not limited to, Social Security Acts, as to all employees engaged in the performance of the Work subject to this Agreement, and further agrees to meet all requirements that may be specified under regulations of government officials having jurisdiction over the Work. All sales taxes, state and municipal taxes, business privilege taxes and use taxes are expressly included within the compensation owed to the Contractor under the terms of this Agreement. It is further agreed that the Owner shall have the right to deduct the amount of any and all such taxes from the compensation owed to the Contractor under the terms of this Agreement at any time, in the Owner's sole discretion, as the Owner deems advisable, it being agreed that the Owner shall have the right to deduct any and all such moneys from the next payments due under this Agreement and from the retained percentages.

§ 3.6.2 The Contractor hereby accepts and assumes full and exclusive liability for and shall indemnify, protect and save harmless the Architect and Owner from and against the payment of:

.1 All contributions, taxes or premiums (including, without limitation, interest and penalties thereon) which may be payable under any unemployment insurance laws of any state, the Older Workers Benefit Protection Act of 1990 (OWBPA) (P.L. 101-433, October 16, 1990, 104 Stat. 978), as amended from time to time, the Federal Social Security Act, as amended from time to time, Federal, State, County and/or Municipal tax withholding laws, or any other laws, measured upon the payroll of or required to be withheld from employees, by whomever employed, engaged in the Work.

.2 All sales, use, personal property and other taxes (including, without limitation, interest and penalties thereon) required by any Federal, State, County, Municipal or any other laws to be paid or collected by the Contractor or any of its Subcontractors or vendors or any other person acting for, through or under it or any of them by reason of the performance of the Work or the acquisition, ownership, furnishing or use of any materials, equipment, supplies, labor, services or other items for or in

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connection with the Work.

.3 All pension, welfare, vacation, annuity and other union benefit contributions payable under or in connection with labor agreements with respect to all persons, by whomsoever employed, engaged in the Work.

.4 In the event that any law is or has been passed, or any rule or regulation pursuant thereof is enacted, which requires the Owner to pay, either directly or indirectly, the amount of any such sales, use, personal property and other taxes (including, without limitation, interest and penalties thereon) required by any Federal, State, County, Municipal or any other laws or should any such law, rule or regulation direct the Owner to collect the same, or make the Owner liable for the collection thereof, or make the Owner responsible therefor, it is covenanted and agreed that the Contractor shall fully and completely make all payments therefor, and shall fully and completely indemnify and save the Owner harmless from any and all such taxes.

§ 3.6.3 The Contractor shall base its Bid on the properly charged, collected and remitted sales tax due on only those "construction activities" which are presumed to become a permanent part of the real estate in accordance with 61 Pa. Code Section 31.11, et seq., as amended from time to time. The Contractor shall not include in its Bid any tax for "sales activities" which do not become a permanent part of the real estate in accordance with 61 Pa. Code Section 31.11, et seq., as amended from time to time. For all such "sales activities" the Contractor will receive an appropriate executed blanket exemption certificate from the Owner.

§ 3.6.4 The Contractor shall keep detailed records of all materials, equipment and labor furnished in connection with the Work and shall keep such full and detailed accounts as may be necessary for the proper financial management under this Agreement and the system utilized by the Contractor shall be satisfactory to the Owner. The Owner or its representative shall be afforded access to the Contractor's records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, certifications and similar data relating to this Agreement. Further, the Owner or its representative shall have the authority, but not the obligation, to require the Contractor to provide the Owner with certified payroll records for the labor furnished by the Contractor in connection with the Work.

§ 3.6.4.1 The Contractor shall preserve all such records for a period of three (3) years, or for such longer period as may be required by law, after final payment. To the extent requested by Owner, copies of such records will be provided by the Contractor. Also, the Contractor shall immediately transmit to the Owner copies of all invoices and receipts for materials, equipment and labor furnished in connection with the Work by the Contractor and any other materials that reflect sales and use tax paid or not paid.

§ 3.6.5 If any sales or use tax exemption is available for the Project, the Owner agrees to provide the Contractor with the necessary certification to obtain any such tax exemption. The Contractor agrees to assign and transfer to the Owner all of its rights to sales and use tax which may be refunded as a result of a claim for refund for materials and/or equipment purchased for the Project. The Contractor further agrees that it will not file a claim for refund for any sales or use tax which is the subject of this assignment. This assignment will include, without limitation, any tax erroneously paid by the Contractor. Further, the Contractor agrees to execute all such documents as may be necessary to effectuate such an assignment.

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

§ 3.7.1 The General Contractor shall make application and the Owner shall pay for the building permit. Singular purpose permits, other governmental fees, licenses and inspections by government agencies necessary for proper execution and completion of the Work shall be the sole responsibility of the Contractor to which they apply and shall be secured prior to the initial Project meeting (e.g., plumbing permit).

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

§ 3.7.2.1 It is the responsibility of the Contractor to determine what local ordinances, if any, will affect its Work. The Contractor shall check for any County, City, Borough, or Township rules or regulations applicable to the area in which the Project is being constructed and in addition, the Contractor shall check for any rules or regulations of other organizations having jurisdiction, including, but not limited to, chambers-of-commerce, industries, or utility companies who have jurisdiction over lands which the Contractor furnishes materials, equipment and labor in connection with the Work. Any costs of compliance with local controls shall be included in the prices bid, even

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though documents of such local controlling agencies are not listed herein.

§ 3.7.2.2 Refer to the Statutory Requirements in Article 16 of these General Conditions.

§ 3.7.3 It shall be the obligation of the Contractor to review the Contract Documents and to notify the Owner and the Architect of any conflict, inconsistency, or discrepancy between standards, codes, laws, ordinances, building codes and regulations of which the Contractor has knowledge or should be reasonably able to determine. The Contractor shall not violate any zoning, setback or other requirements of applicable laws, codes, standards, regulations and/or ordinances, or of any recorded covenants. If the Contractor, any of its Subcontractors or any Sub-Subcontractor performs contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend 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 promptly notify the Owner and Contractor in writing, stating the reasons. Claims by the Contractor in opposition to such determination must be made within twenty-one (21) days after the Architect has given notice of the decision. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

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

§ 3.7.6 If the Contractor, any of its Subcontractors or any Sub-Subcontractors, performs Work contrary to laws, statutes, ordinances, building codes, and rules and regulations, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

§ 3.7.7 In the event that the Contractor pays any monies, including, without limitation, any monies for permit fees, to any State, County, City, Borough, Township, Municipality, or other governmental agency and such State, County, City, Borough, Township, Municipality, or other governmental agency refunds such monies (except refunds to the Contractor where the Contractor succeeds in its challenge to repeal a standard, code, law, ordinance and/or requirement of any state, federal or other governmental agency as set forth in Paragraph 3.7.8 of these General Conditions), then the Contractor agrees to assign and transfer to the Owner all its rights to such monies.

§ 3.7.8 Notwithstanding the foregoing, in the sole instance where the Contractor challenges the validity of any standard, code, law, ordinance, and/or requirement of any state, federal or other governmental agency and as a result of the Contractor's efforts such standard, code, law, ordinance, and/or requirement is repealed, then any monies including, without limitation, permit fees, which are refunded as a result thereof, by any State, County, City, Borough, Township, Municipality or other governmental agency to the Contractor for the Project shall be shared with the Owner receiving sixty percent (60%) and the Contractor receiving forty percent (40%) of the refunded monies. The Contractor agrees to assign and transfer to the Owner its right to sixty percent (60%) of the monies.

§ 3.7.9 Furthermore, the Contractor agrees to execute all such documents as may be necessary to effectuate the assignment contemplated in Paragraphs 3.7.7 and 3.7.8 of these General Conditions.

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§ 3.8 ALLOWANCES

§ 3.8.1 NO CASH ALLOWANCES: No cash allowances for any purpose are included in the Project Manual and Contract Documents of this Project.

3.9 SUPERINTENDENT

§ 3.9.1 Each Contractor shall employ a competent superintendent and necessary assistants who shall be in constant attendance at the Project site during the progress of the Work, and shall provide adequate supervision and superintendence to assure that all Work is being performed in accordance with the Contract Documents. 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.

§ 3.9.2 Each Contractor, within five (5) days following Notice of Intent to Award, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent, which qualifications shall include at least three (3) recent projects of similar contract size and scope, with the names and telephone numbers of the Owner and Architect representative for each project. The Architect may reply to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review.

§ 3.9.3 The Superintendent shall be on site full time and shall not be changed except with the consent of the Owner, unless the Superintendent proves to be unsatisfactory to the Contractor and ceases to be in the Contractor's employ. If the Contractor should at any time fail to provide adequate supervision and superintendence, as may be evidenced by incomplete, delayed or non-conforming Work, the Owner may provide supervision and superintendence and the cost thereof, including, but not limited to, compensation for additional professional services, legal fees, or other costs or expenses incurred, shall be charged to the Contractor in the form of a Change Order incorporating an appropriate reduction in the Contract Sum. If the payments due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner. The Owner and Architect shall have the right to dismiss from the Project any Superintendent whose performance is not satisfactory in the sole discretion of the Owner.

§ 3.9.4 As a consideration of the Contract between the Owner and the Contractor, the Contractor shall retain the same Superintendent for its Work on the Project while on the Project. The Superintendent shall not be reassigned from this Project prior to completion, unless by termination of employment by the Superintendent or the Contractor, or if required by the Architect or by the Owner in accordance with Paragraph 3.9.3.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 Each Prime Contractor, not later than the time period indicated in the Division 01 Section "Construction Progress Documentation", shall prepare and submit to the Architect, through the Project Coordinator, a preliminary construction schedule for the Work. Such schedule shall not exceed time limits stipulated in the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, or as requested by the Architect, shall be related to the entire Project 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 prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.2.1 The Contractors shall cooperate and consult with other Prime Contractors during the construction of this Project. Each Contractor shall schedule and execute its Work so as to avoid delay to other Contractors. Each Contractor is financially responsible to the other Contractors for undue delay caused by it to other Prime Contractors on the Project. Each Contractor shall defend and hold harmless the Owner and Architect for any claims, losses or delays of any kind whatsoever made by other Contractors arising from delays caused by Contractor.

§ 3.10.3 The Contractor, not later than the time period indicated in the Division 01 Section "Submittal Procedures",

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shall prepare and submit to the Architect, through the Project Coordinator, a schedule of shop drawing submittals which will be reviewed by the Architect for the orderliness of the submittals by the Contractor. This schedule shall be provided to the Architect for approval by the Architect not later than the time period indicated in the Division 01 Section "Submittal Procedures". The schedule shall be coordinated with the Project's construction schedule and shall allow the Architect reasonable time to review submittals.

§ 3.10.4 The Owner shall have the right to direct a postponement or rescheduling of any date or time for the performance of any part of the Work that may interfere with the operations of the Contractors or of the Owner's premises or any of the Owner's operations. The Contractor shall, upon the Owner's request, schedule any portion of the Work affecting other Contractors or the operation of the premises during hours when the premises are not in operation. Any postponement, rescheduling, or performance of the Work under this Paragraph may be grounds for an extension of the Contract Time, if permitted under Paragraph 8.3.1.

§ 3.10.5 Failure of Contractor to fully comply with requirements of Paragraph 3.10 and the other Contract Documents regarding scheduling shall constitute default by Contractor of its obligations, sufficient for termination of the Contract.

§ 3.10.6 Progress payments to the Contractor shall not occur until the Contractor has met the requirements of schedule information stated in Paragraph 3.10 and the Contract Documents.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors. Submittals which are not marked as reviewed for compliance with the Contract Documents and approved by the Contractor may be returned by the Architect without action. The Contractor shall forward to the Architect a copy of the transmittal covering each such submittal.

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

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

§ 3.14 CUTTING AND PATCHING

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

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

§ 3.14.3 The Contractor, Subcontractor or Sub-Subcontractor requiring the cutting of openings in new work installed by other Contractors shall have such openings cut and patched by the trade which installed the Work and such cutting and patching shall be at the expense of the Contractor, Subcontractor or Sub-Subcontractor requiring the opening. Approval to do such cutting and patching shall be received from the Architect prior to proceeding with the

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Work and shall include installation of such reinforcement of the Work as the Architect may direct, at no additional cost to the Owner. Blocking, bracing, reinforcement, or structural enhancement required, due to cutting and patching, shall be provided at no additional cost to the Owner. Patching Work shall match adjacent existing Work unless otherwise noted.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project. The Contractor shall clean the Work areas daily and should the occasion arise that the Architect must direct the Contractor to clean an area, the Contractor shall do so within twenty-four (24) hours. If the Contractor fails to clean up the specific area within the allotted time, the Owner may do so immediately, and the cost thereof shall be charged to the Contractor.

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

§ 3.16 ACCESS TO WORK

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

§ 3.17 ~~ROYALTIES, PATENTS AND COPYRIGHTS~~ TEMPORARY HEAT

~~The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect~~. In the event that the Work requires the Contractor to remove, deactivate, or otherwise disable any heating system on Owner's property during the heating season (typically October 14th through April 30th), the Contractor shall, at its own expense and with the pre-approval of the Owner, provide such temporary heating as shall be required.

§ 3.18 INDEMNIFICATION

§ 3.18.1 ~~To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, and consultants, agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to , injuries to the Contractor's employees, legal fees and defense costs, arising out of or resulting from performance of the Work, but only to the extent caused, in whole or in part, by the acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts or omissions 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. The Contractor agrees to and does hereby assume on behalf of the Owner and Architect the defense of any action, at law or in equity, which may be brought against such indemnities, upon their demand, the amount of any judgment that may be entered against such indemnities in any such action. In the event that any such claim, loss, cost, expense, liability, damage or injury arises or is made, asserted or threatened against the Owner for which the Contractor or its insurer does not admit coverage, or if the Owner reasonably determines such coverage to be inadequate, the Owner shall have the right to withhold from Contractor any payments due or to become due to the Contractor in an amount sufficient to protect the Owner from such claim, loss, cost, expense, liability, damage or injury, including, but not limited to, legal fees and expenses reasonably necessary for the defense thereof.~~ To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, and consultants, agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to, injuries to the Contractor's employees; loss of use of Owner's property; injuries to residents resulting from loss of use, heat, colling, utilities, etc. to the extent such losses are caused by the acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts or omissions they may be liable, and/or resulting from the performance of the Work; legal fees and defense costs, arising out of or resulting from performance of the Work, but only to the extent caused, in whole or in part, by the acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for

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whose acts or omissions 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. The Contractor agrees to and does hereby assume on behalf of the Owner and Architect the defense of any action, at law or in equity, which may be brought against such indemnities, upon their demand, the amount of any judgment that may be entered against such indemnities in any such action. In the event that any such claim, loss, cost, expense, liability, damage or injury arises or is made, asserted or threatened against the Owner for which the Contractor or its insurer does not admit coverage, or if the Owner reasonably determines such coverage to be inadequate, the Owner shall have the right to withhold from Contractor any payments due or to become due to the Contractor in an amount sufficient to protect the Owner from such claim, loss, cost, expense, liability, damage or injury, including, but not limited to, legal fees and expenses reasonably necessary for the defense thereof.

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

§ 3.18.3 Each Contractor shall indemnify and hold harmless the Owner against any assertion of claims for mechanics' liens by the Contractor, its Subcontractors, Sub-Subcontractors or material suppliers and against any assertion of security interests by its suppliers of goods or materials.

§ 3.18.4 No provision of Paragraph 3.18 shall give rise to any duties on the part of the Architect or the Owner not otherwise provided for by this Agreement or by law.

§ 3.18.5 In the event that the Contractor is requested but refuses to honor the indemnity obligations hereunder, then the Contractor shall, in addition to all other obligations, pay the cost of bringing any such action, including, but not limited to, legal fees, to the party requesting indemnity, including, but not limited to, any legal fees and costs incurred in enforcing the indemnity obligations hereunder. Furthermore, the Contractor shall be solely responsible for all legal fees incurred by the Owner in defending, removing, marking satisfied mechanics' liens or any other expenses incurred by Owner in connection with mechanics' lien claims and/or judgments.

§ 3.19 REPRESENTATIONS AND WARRANTIES

§ 3.19.1 Each Contractor shall be responsible for preparing and completing its own comprehensive list of items to be completed or corrected (punch-list) in order to submit for Substantial Completion. If after the punch-list is submitted and upon inspection, it is found that a Contractor's punch-list is incomplete, lengthy or ill prepared, the Substantial Completion request will be denied. If it is required because of a Contractor's incomplete, lengthy or ill prepared punch-list or a Contractor's inability to complete its punch list and, therefore, complete the Contract, that the Architect, or any of its consultants or representatives or the Owner, is required to prepare a punch list, such Contractor will be solely responsible for such costs. In the event that the Architect or any of its consultants or representatives, or the Owner is required to prepare punch-lists, the Contractor that is required to complete the punch-list to complete the Contract will be in default of the Contract.

In the event the Contractor or its Subcontractor fails to complete these punch-lists, the Owner may: (i) exercise any available remedies under this Agreement, at law, and/or at equity to correct or complete deficient Work or retain a third party to correct or complete such Work at the cost of the defaulting Contractor; and (ii) retain and deduct from any payments or retention otherwise due to the defaulting Contractor any fees and expenses for services required to be provided to correct or complete such deficient Work. The Architect and/or any of its consultants or representatives and/or the Owner will be compensated for such additional work at standard prevailing rates by the Contractor.

The Contractor represents and warrants the following to the Owner (in addition to the other representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute this Agreement, which representations and warranties shall survive the execution and delivery of this Agreement and the Final Completion of the Work:

.1 that it is financially solvent, able to pay its debts as they mature and possess sufficient working capital to complete the Work and perform its obligations under the Contract Documents;

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.2 that it is able to furnish the personnel, tools, materials, supplies, equipment and labor required to complete the Work and perform its obligations hereunder and has sufficient experience and competence to do so;

.3 that it is authorized to do business in the Commonwealth of Pennsylvania and is properly licensed by all necessary governmental and public and quasi-public authorities having jurisdiction over it and over the Work and the site of the Project;

.4 that its execution of this Agreement and its performance thereof is within its duly authorized powers;

.5 that it is familiar with all Federal, State, Municipal and Department laws, ordinances and regulations, which may in any way affect the Work of those employed herein, including, but not limited to, any special acts relating to the Work or to the Project of which it is a part;

.6 that such temporary and permanent Work required by the Contract Documents as is to be done by it, can be satisfactorily constructed and used for the purposes for which it is intended, and that such construction will not injure any person or damage any property;

.7 that it is familiar with local trade jurisdictional practices at the site of the Project;

.8 that it has carefully examined the Plans, the Specifications and the site of the Work, and that, from its own investigation, it has satisfied itself as to the nature and location of the Work, the character, quality and quantity of the surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the Work, and the general local conditions, and all other materials which may in any way affect the Work or its performance; and

.9 that it has determined what local ordinances, if any, will affect its Work. The Contractor has checked for any County, City, Borough, or Township rules or regulations applicable to the area in which the Project is being constructed and in addition, the Contractor has checked for any rules or regulations of other organizations having jurisdiction, including, but not limited to, such as chambers-of-commerce, planning commission, industries, or utility companies who have jurisdiction over lands which the Contractor occupies. Any costs of compliance with local controls shall be included in the prices bid, even though documents of such local controlling agencies are not listed herein.

§ 3.20 The Contractor agrees (in addition to the representations and warranties contained in the Contract Documents), as an inducement to the Owner to execute the Contract, that the Contractor shall be restricted to the rights and remedies set forth in Article 15 of these General Conditions for all disputes between the Contractor and the Owner. However, the Owner's right to recover under the Contract Documents, at law or in equity shall not be restricted to the rights and remedies set forth in Article 15 of these General Conditions. This Paragraph shall survive the execution and delivery of this Agreement and the Final Completion of the Work.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

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

§ 4.1.3 In case of termination of employment of the Architect, the Owner shall appoint a new Architect accordingly.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment and with the Owner's concurrence, from time to time during the one (1) year period for correction of the Work described in Section 12.2 hereof. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with and to keep the Owner informed about the progress and quality of the portion of the Work completed, to guard the Owner against defects and deficiencies in the Work, and to

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determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. 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 separate contractors shall be through the Owner.

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

§ 4.2.6 The Architect or Owner has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect or Owner considers it necessary or advisable, the Architect or Owner will have authority to require 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. However, neither this authority of the Architect or Owner nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or Owner to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness as to cause no delay in the Work or in the activities of the Owner, Contractor or separate contractors, 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.

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

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

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§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The 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.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. However, the Architect shall not have the authority to bind the Owner to accept Work to which the Owner objects as being deficient or otherwise inconsistent with the Contract Documents,

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and initial decisions, the Architect, in the absence of negligence, will not be liable for results of interpretations or decisions rendered in good faith.

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information., at no additional cost to the Owner.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

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

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

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

§ 5.2.1 No later than five (5) days from receipt of the Notice of Intent to Award, the Contractor shall furnish the Owner, and the Architect, in writing, (1) the name, trade, and Subcontract amount for each Subcontractor, (2) the names of all persons or entities proposed as manufacturers of the products identified in the Specifications (including, without limitation, those who are to furnish materials or equipment fabricated to a special design) and, where applicable, the name of the installing Subcontractor. Not later than five (5) days subsequent to the execution of the Owner-Contractor Agreement, the Contractor shall furnish the Owner, and the Architect, in writing, (3) copies of any and all agreements by, between and among the Contractor and each Subcontractor along with all documentation related to such agreements. The Contractor agrees that the Owner will be a third party beneficiary of each Subcontract. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review.

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

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. No increase in the Contract Sum shall be allowed for any such substitution.

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

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§ 5.3 SUBCONTRACTUAL RELATIONS

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

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

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

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

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

.3 the Contractor agrees upon Owner's request to execute whatever instruments Owner may require confirming any such assignment.

Except as set forth in Section 5.4.3 hereof, when the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity and in such case the successor contractor or other entity and not the Owner shall assume the Contractor's rights and obligations under the subcontract.

§ 5.5 PAYMENTS TO SUBCONTRACTORS OR MATERIAL SUPPLIER BY THE CONTRACTOR

§ 5.5.1 The Contractor shall pay each Subcontractor, upon receipt of payment from the Owner, an amount equal to the percentage of completion allowed to the Contractor, on account of such Subcontractor's work, less the percentage retained from payments to the Contractor. The Contractor shall also require each Subcontractor to make similar payments to Sub-Subcontractors. All such payments shall be paid within twenty (20) days. In the event a Subcontractor or material supplier alleges that the Contractor has failed to pay it in full, the Owner may, in addition to its other rights, set off said amounts from any amount due and owing to the Contractor.

§ 5.6 PAYMENTS TO SUBCONTRACTORS BY THE OWNER.

§ 5.6.1 If the Owner fails to approve an Application for Payment for a cause which the Owner and Architect determine is the fault of the Contractor, and not the fault of the particular Subcontractor, or if the Contractor fails to make payment which is properly due to a particular Subcontractor, the Owner may pay such Subcontractor directly, less the amount to be retained under its Subcontract. Any amount so paid by the Owner shall be repaid to the Owner by the Contractor in the manner set forth in Paragraph 2.4.

§ 5.6.2 The Owner shall have no obligation to pay, or to see to the payment of, any monies to any Subcontractor or material supplier. Nothing contained in Paragraph 5.6.1 shall be deemed to create any contractual relationship between the Owner and any Subcontractor or to create any rights in any Subcontractor against the Owner.

§ 5.6.3 The Contractor shall promptly advise the Owner and the Architect of any claim or demand by a Subcontractor claiming that any amount is due to such Subcontractor claiming any default by the Contractor in any of its obligations to such Subcontractor.

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ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate 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 these including those portions related to insurance and waiver of subrogation. This Project will be performed with multiple Prime Contractors as indicated in the Contract Documents. The Contractors shall be aware that schedule adjustments will be required to coordinate with the Work of their Contract with the Work of other Prime Contractors.

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

§ 6.1.3 The Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts, the Owner shall provide for coordination of such forces with the Work of the Contractor, who shall cooperate with them.

§ 6.2 MUTUAL RESPONSIBILITY

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the 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 or separate 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 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall not be responsible for any additional costs due to delays and that, if justified, Contractor is only entitled to an extension of time as full compensation for any delay created by the Owner as set forth in Section 8.3.4 hereof.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5. The Contractor agrees to defend, indemnify and hold the Owner harmless from any claims or damages brought by a separate Contractor arising out of actions or omissions of the Contractor or his Subcontractors or suppliers in performing its Work under the Contract Documents.

§ 6.2.5 DISPUTES OR ACTIONS BETWEEN CONTRACTORS

§ 6.2.5.1 Should the Contractor, either itself or by its Subcontractor or Sub-Subcontractors or their respective agents, servants, or employees, cause damage or injury to the property or Work of other Contractors or Subcontractors, or by failing to perform its Work (including, without limitation, the Work of its Subcontractor or Sub-Subcontractors) with due diligence, delay any Contractor or Subcontractors, which suffer additional expense or damage as a result, the parties involved in such dispute and their respective Sureties shall settle by agreement or arbitrate said claim, dispute or action by referring same to the American Arbitration Association. Said claim, dispute or action shall be determined pursuant to the Construction Industry Arbitration Rules of the American Arbitration Association then in effect. The Owner will not be a party to disputes or actions between Contractors, the Sureties or Subcontractors concerning such additional expense or damage. It is agreed by all parties that claims, disputes or actions between Contractors, Sureties and Subcontractors concerning the additional expense or damage will not delay completion of the Work, which shall be continued by the parties, subject to the rights hereinbefore provided. It is agreed by the parties to this Agreement (the Owner as promisee and the Contractor as promisor) that the intent of this clause is to benefit the Contractors and their Sureties on the Project and to serve as an indication of the mutual intent of the Owner and the Contractor that this clause raise such other Contractors to the status of third party beneficiaries only as to the terms and conditions of each paragraph of Article 6. The Contractor agrees that the paragraphs of Article 6

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are provided as a benefit to the Contractor and, that they specifically exclude claims, disputes or actions against the Owner for delay or other damages.

§ 6.2.5.2 The Contractor agrees that all claims, disputes and other matters in question between Prime Contractors, their Sureties or Subcontractors, which arise out of, or are related to this Agreement, or the breach thereof, as provided in Subparagraph 6.2.5.1, shall be settled by agreement or resolved by arbitration, in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association then in effect, unless the parties mutually agree otherwise. This agreement to arbitrate is in consideration of the fact that all other Prime Contractors agree to this same arbitration provision, as provided in each separate Prime Contract required for the construction of this Project, and is specifically enforceable under the prevailing arbitration law. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in accord with applicable law in any court having jurisdiction thereof. The Owner shall not be a party to this arbitration.

§ 6.2.5.3 Notice of the demand for arbitration shall be filed in writing with the other Prime Contractor(s) and with the Regional Office of the American Arbitration Association. A copy of the demand shall be filed with the Architect and the Owner. The demand for arbitration shall be made within thirty (30) days after the claim, dispute or other matter in question has arisen. The Owner shall not be a party to the claim, dispute or other matter in question, but shall be a witness in any arbitration at the request of any party to the arbitration. The Owner will be provided with copies of all documents submitted to the arbitrator at no cost to the Owner.

§ 6.2.5.4 The Contractor hereby agrees that the Contractor's sole remedy for including, without limitation, injuries, damages or expenses resulting from disputes between Contractors, Sureties or Subcontractors will be to seek recovery from the other Contractors, Sureties or Subcontractors for the transgressions of such other Contractors, Sureties or Subcontractors. The Contractor hereby further agrees that it shall have no recourse against the Owner for the transgressions of other Contractors, Sureties or Subcontractors that result in including, without limitation, delay, acceleration, out-of-sequence Work, overtime, stacking of trades, failure to adequately clean the work areas, disputes over the scope of the Contractor's work, or disputes between Contractors, Sureties or Subcontractors regarding any other matter concerning the Project.

§ 6.2.5.5 The Contractor acknowledges that the restrictions contained in these General Conditions are reasonable and necessary in order to protect the legitimate interests of the Owner and that any violation of these General Conditions would result in irreparable injuries to the Owner and monetary damages would be inadequate to compensate the Owner for a violation of these General Conditions. Therefore, the Contractor hereby agrees that if the Contractor disregards any paragraph of these General Conditions, including, without limitation, any portion of this Article 6, and institutes or attempts to institute any proceeding (e.g., arbitration, litigation, mediation, etc.) against the Owner for including, without limitation, injuries, damages or expenses resulting from disputes between Contractors, Sureties or Subcontractors, the Owner is entitled to obtain from any court of competent jurisdiction preliminary and permanent injunctive relief to prevent the Contractor from pursuing any proceeding against the Owner and the Owner is entitled to stay any such proceeding. In the event that the Owner pursues preliminary or permanent injunctive relief to prevent the Contractor from pursuing any proceeding against the Owner or that the Owner attempts to stay any such proceeding, the Contractor and the Contractor's Surety shall be jointly and severally liable for and shall reimburse the Owner immediately upon demand for including, without limitation, all legal fees, professional fees and all other costs associated therewith incurred by the Owner. The Owner's rights set forth in this Paragraph 6.2.5.5 shall be in addition to all other rights of the Owner granted in the Contract Documents, at law, or in equity.

§ 6.2.6 In case any direct or indirect injury is done to existing, street or underground structures, sewers, mains, or to public or private property of any kind, or to any materials or fixtures, by or because of the Work, in consequence of any act or omission on the part of the Contractor, its employees or agents, the Contractor, at its own cost and expense, except where hereinafter specified otherwise, shall restore such structures, property, or materials to a condition equal to or similar to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise as may be required by the Architect and Owner. To the extent that the Contractor fails or refuses to meet the requirements of this Paragraph and such failure and/or refusal results in the Owner incurring additional legal fees, professional fees, other cost or expenses, the Contractor shall be liable for the same.

§ 6.2.7 If the Contractor fails to restore such property or make good such damage, the Owner may, by contract or otherwise, proceed to repair, rebuild, or otherwise restore such property as may be necessary, and the cost thereof will be deducted from any money due, or to become due, the Contractor under this Contract; or the Owner may

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deduct from any money due the Contractor a sum sufficient to reimburse the Owner of property so damaged. If the amount owed is not sufficient to reimburse the Owner, the Contractor will pay the Owner said amount immediately upon demand.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

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

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

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

§ 7.2 CHANGE ORDERS

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

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

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

§ 7.2.3 To the extent that any Contractor makes an excessive number of Change Order requests, which excessiveness, shall be determined solely in the discretion of the Owner, the Owner shall have the authority in its sole discretion, to disregard any subsequent Change Order requests made by such Contractor on the same or similar scope of services and the Contractor's sole remedy against the Owner under this Agreement shall be pursuant to Article 15 of these General Conditions. Furthermore, to the extent the Owner incurs any legal fees, professional fees, expenses or costs (including, but not limited to, employee costs), arising out of or resulting from the Contractor making an excessive number of Change Order requests, the Contractor shall be liable for such legal fees, professional fees, expenses and costs.

§ 7.2.4 Any action(s) by the Owner, Architect and/or the Contractor other than actions taken pursuant to the procedures set forth in Paragraph 7.2.1 shall not constitute the approval of a Change Order, including, without limitation, the Owner's, and/or the Architect's execution of the Contractor's time sheets upon which the Contractor submits a Change Order request. Furthermore, to the extent the Owner incurs any legal fees, professional fees, expenses or costs (including, but not limited to, employee costs), arising out of or resulting from the Contractor's failure to follow the proper procedures for approval of a Change Order, the Contractor shall be liable for such legal fees, professional fees, expenses and costs.

§ 7.2.5 So as not to unduly delay the Project when a Contractor's Change Order request has not been approved pursuant to the procedures set forth in Paragraph 7.2.1 within thirty (30) days of the Contractor's submittal of such Change Order, or where the parties cannot agree as to the amount of compensation for a Change Order, the Contractor shall continue to perform its services and the Contractor's sole remedy against the Owner under this Agreement shall be pursuant to Article 15 of these General Conditions.

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§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

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

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

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so 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.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time. Notwithstanding anything else to the contrary in the Contract Documents, when a Construction Change Directive is not agreed upon by the Contractor, the Contractor shall continue to perform the change in the Work involved so as not to delay the Project and the Contractor's sole remedy against the Owner under this Agreement shall be pursuant to Article 15 of these General Conditions.

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

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for combined office and field overhead (i.e. General Conditions and General Requirements – Division 1 of the Specification) and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 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;
- **.4** Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work shall be submitted without mark up; and
- **.5** Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.7.1.1 Labor: (As specified in Section 7.3.7.1) Labor costs shall be the certified Base Prevailing Wage Rate, plus actual fringe benefits per wage determination (bound in the Project Manual) plus FICA, SUTA, FUTA and Workmen's Compensation.

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

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment to the extent that such Work was completed under the Construction Change Directive. For any portion of such cost that remains in dispute, the Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

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

§ 7.3.11 In Paragraph 7.3.7, the allowance for the combined office and field overhead (i.e., General Conditions and General Requirements – Division 01 of the Specifications) and profit included in the total cost to the Owner shall be based on the following schedule:

.1 For the Contractor, for Work performed by the Contractor's own forces, ten percent (10%) of the cost.

.2 For the Contractor, for Work performed by the Contractor's Subcontractor, five percent (5%) of the amount due the Subcontractor.

.3 For each Subcontractor or Sub-Subcontractor involved, for Work performed by the Subcontractor's or Sub-Subcontractor's own forces, five percent (5%) of the cost.

.4 Cost to which office and field overhead (i.e., General Conditions and General Requirements-Division 01 of the Specifications) and profit is to be applied shall be determined in accordance with Paragraph 7.3.7.

.5 In order to facilitate checking of quotation for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including, without limitation, labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving an amount greater than or equal to Two Hundred Dollars ($200.00) be approved without such itemization.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has 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 will be effected by written order signed by the Architect 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.

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§ 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. The dates listed in the Preliminary Construction Schedule, if provided, are minimum performance dates and each Contractor agrees to schedule, coordinate, and staff in accord with actual progress of the Work. Each Contractor agrees to increase manpower, increase work hours, and to increase equipment necessary to maintain the Project schedule. Such measures undertaken by each Contractor will be at no additional cost to the Owner.

§ 8.2.1.1 Any Preliminary Construction Schedule, if provided, is for information purposes only and constitutes a proposed sequence of events based on standard practices.

§ 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 and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time. Each Contractor agrees to increase manpower, increase work hours, and to increase equipment necessary to maintain the Project schedule. Such measures undertaken by the Contractor will be at no additional cost to the Owner.

§ 8.2.4 It is mutually agreed by and between the parties hereto that time shall be an essential part of this Contract and that in case of the failure on the part of the Contractor to complete the Contract within the time specified and agreed upon, the Owner will be damaged thereby. Further, it is mutually agreed that the amount of said damages, including, but not limited to, expenses for inspection, superintendence and necessary traveling expenses, being difficult, if not impossible, of definite ascertainment and proof, it is hereby agreed that the reasonable amount of liquidated damages shall be in accordance with Paragraph 9.11.

§ 8.2.4.1 In addition to the liquidated damages set forth in Article 9, the Contractor agrees to pay all associated costs for the Architect to extend their Agreement to remain on the Project due to the failure of the Contractor to complete the Work within the time frame stipulated in the Project schedule. Damage to other Prime Contractors that are an extension of this clause are to be recovered pursuant to Article 6.2 of the General Conditions.

§ 8.2.4.1.1 The determination of costs will be based on the level of completion of the Work by the Contractor.

§ 8.2.4.1.1.1 Should a single Contractor fail to complete the Project within the time frame stipulated in the Project Schedule, that sole Contractor shall be responsible for all costs listed in Paragraph 8.2.4.1.

§ 8.2.4.1.1.2 Should more than one Contractor fail to complete the Project within the time frame stipulated in the Project schedule, the costs will be proportionate to the level of the completion of the Work and the value of each Contractor's Contract Sum weighed against the total Project cost of all separate Agreements.

§ 8.2.5 Application of Provisions

§ 8.2.5.1 In accordance with the requirements of Division 01 Section "Construction Progress Documentation", the Contractor must present to the Architect a Preliminary Construction Schedule. If shift, premium time, or overtime work must be utilized to permit timely completion, it should be so noted on the Preliminary Construction Schedule. The cost of the shift, overtime or premium time is to be included in the Contractor's Bid price. The cost of all schedule submittals is the responsibility of the Contractor.

§ 8.2.5.2 Bi-weekly updates to the Final Construction Schedule shall be provided by the Contractors in a format approved by the Owner and Architect.

§ 8.2.6 Progress Meetings

§ 8.2.6.1 During the construction period, the Contractor shall provide weekly to the Architect and the Owner's representative a biweekly progress update report showing progress during the previous week and any changes to accepted schedule. This will be provided in a format approved by the Owner and Architect.

§ 8.2.6.2 There will be biweekly meetings during the construction period. The Contractor must have an on-site

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superintendent available to attend these meetings and be responsible for interfacing with the overall planning and coordination effort. Meetings may be held more or less frequently at the discretion of the Owner and/or Architect and updates to the Final Construction Schedule may be requested more frequently than on a bi-weekly basis at the discretion of the Owner and/or Architect.

§ 8.2.7 Adherence to Schedule

§ 8.2.7.1 The Owner reserves the right to withhold monthly progress payments if the Contractor is behind schedule, unless the Contractor proves, in writing, that the delays are not the fault of the Contractor and to which the Architect agrees.

§ 8.2.7.2 The monthly progress payments will only be released after the Contractor reaches the status of completion for that month comprehended by the Project construction schedule.

§ 8.2.7.3 In the event the Owner, after consultation with the Architect, determines that the performance of the Work has not progressed or reached the level of completion required by the Contract Documents, and the Project construction schedule, the Owner shall have the right to order the Contractor to take corrective measures necessary to expedite the progress of construction, including, but not limited to, working additional shifts or overtime; supplying additional manpower, equipment, and facilities; and other similar measures (referred to collectively as "Extraordinary Measures"). Such Extraordinary Measures shall continue until the progress of the Work complies with the stage of completion required by the Contract Documents. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the Project construction schedule and failure to comply shall be considered as breach of the Contract Documents.

.1 The Contractor shall not, under any circumstances, be entitled to an adjustment in the Contract Sum in connection with Extraordinary Measures required by Owner under or pursuant to this Paragraph 8.2.

§ 8.2.7.4 The Owner may exercise its rights pursuant to Paragraph 8.2 as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with any completion dates set forth in the Contract Documents.

§ 8.2.8 Procurement Schedule

§ 8.2.8.1 If requested by the Owner, the Contractor shall provide a Procurement Schedule within a reasonable period of time which shows items to be purchased, date of purchase, quoted dates of delivery, current estimated date of delivery, and last date of contact with the vendor. The Procurement Schedule shall be updated biweekly and presented to the Architect.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Architect, 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 litigation; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine. Where the delay arises from acts, omissions, or defaults of another Contractor or the other Contractor's, Subcontractors and suppliers, then the Contractor will be entitled no extension of time and its sole remedy will be an arbitration proceeding pursuant to Paragraph 6.2.5 of the General Conditions.

§ 8.3.1.1 No extension of Contract Time will be considered or approved if the act or occurrence constituting the basis of the request or claim is for nondelivery of materials due to any act or neglect of the Contractor, or the failure of the Contractor to employ, furnish or obtain, as necessary for the timely prosecution of the Work, shop drawings, sufficient labor, materials or equipment, or other matters which shall be within the control of the Contractor. Any delay which results due to any of the foregoing causes shall be the sole responsibility of the Contractor.

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

§ 8.3.3 No payment or compensation will be made to the Contractor as compensation for damages for any delays or hindrances from any cause whatsoever in the progress of the Work, notwithstanding whether such delays be avoidable or unavoidable. The Contractor's sole remedy for delays shall be an extension of Contract Time, pursuant to and only in accordance with this Paragraph 8.3. Such extension shall be a period equivalent to the time lost, day

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for day, by reason of any and all of the aforesaid causes. Nor will the Contractor be permitted to make any claim for acceleration or for costs or expenses associated with acceleration nor will the Contractor be permitted to make a claim for out-of-sequence work (e.g., winter protection costs). In the event that the Contractor chooses to assert such a claim for delay, acceleration or out-of-sequence work, or litigate this provision, and the Contractor fails to prevail as to its entire claim in its litigation, the Contractor shall be liable to the Owner and shall reimburse the Owner for any legal fees, professional fees, costs or expenses associated with analyzing, defending or otherwise opposing any such claim or litigation.

§ 8.3.4 The Owner shall not be liable to the Contractor for any expenses, damages, loss of profits (anticipated or otherwise) or charges of any nature whatsoever (including, but not limited to, legal fees and professional fees) which shall result because of any extension of the time of completion which shall be granted by the Owner to the Contractor or to any other Contractor employed by the Owner to perform any other portion of the Project, or which shall result because of any delay or hindrance of any nature whatsoever in the progress of the Work (e.g. winter protection costs), whether such delay or hindrance shall be avoidable or unavoidable. In the event the Contractor chooses to litigate this provision and fails to prevail as to its entire claim in its litigation, the Contractor shall reimburse the Owner and the Architect for any legal fees, professional fees and all other costs and expenses associated with analyzing, defending or otherwise opposing any such claim or litigation.

§ 8.3.5 The Contractor shall recognize and reasonably anticipate that as the job progresses; the Owner's representative may be making changes in and updating the construction schedules. Therefore, no claim for an increase in the Contract Sum for either acceleration, delay or out-of-sequence work will be allowed for decisions as to extensions of time pursuant to this Paragraph or for other changes in the construction schedules which may be experienced.

§ 8.3.6 No extension of Contract Time granted by the Owner shall be or shall be deemed to be a waiver by the Owner of any rights accruing to it under the General Conditions, and no extension of Contract Time granted by the Owner shall relieve or shall be deemed to relieve the Contractor from full responsibility for performance of the Work of the Contract.

§ 8.3.7 Should the Owner be prevented or enjoined from proceeding with the Project either before or after the start of construction by reason of any litigation or any other reason beyond the control of the Owner, the Contractor shall not be entitled to make or assert claims for damage by reason of said delay or for acceleration or out-of-sequence work; but time for completion of the Work will be extended to such reasonable time as the Owner and Architect may determine will compensate for time lost for such delay with such determination to be set forth in writing.

§ 8.3.8 Any delay attributable to lack of coordination or cooperation by and/or between the Contractors and the Subcontractors, will not be recognized by the Owner as a basis for any claim for increasing any Contract Sum, but shall be settled as provided in Paragraph 6.2 and its Subparagraphs of the General Conditions.

§ 8.3.9 The Contractor's sole remedy for Change Orders shall be an extension of the Contract Time pursuant to this Paragraph 8.3. Such extension of the Contract Time shall be for a period equivalent to a reasonable amount of time to perform the Change Order as the Owner and the Architect determine with such determination to be set forth in writing. Therefore, no claim by the Contractor for an increase in the Contract Sum, out-of-sequence work or for other changes in the construction schedule will be allowed by the Contractor as a result of the Contractor performing Work contained in a Change Order.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

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

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, no later than seven (7) days before the date scheduled for submittal of the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

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§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the Contract Documents, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents. The form of Application for Payment shall be notarized AIA Document G702, Application and Certificate for Payment, supported by AIA Document G703, Continuation Sheet.

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

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

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

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

§ 9.3.4 Payments to the Contractor will be made monthly for Work completed as of the last calendar day of the month, or during a period of one (1) calendar month ending on a day mutually agreed to by the Owner and the Contractor, provided that all requirements of the Agreement have been and are being complied with.

§ 9.3.5 Not later than the day of the month agreed to by all parties concerned, the Contractor shall submit to the Architect, in quadruplicate (4), itemized Applications for Payment, supported to the extent required by the Architect by receipts or other vouchers, showing payments for materials and labor, payments to Subcontractors, manufacturers and suppliers and such other evidence of the Contractor's right to payment as the Architect may direct. At least ten (10) days prior to the date established for the Contractor's submission of the Application for Payment, the Contractor shall provide an informal copy of the Application for Payment to the Architect for his review. The Architect will advise the Contractor as to whether the Application for Payment is acceptable or as to what changes shall be required.

§ 9.3.6 The sum or sums withheld by the Owner from the Contractor shall be ten percent (10%) of the amount due the Contractor until fifty percent (50%) of the Project is completed. Except as otherwise provided herein, when the Project is fifty percent (50%) complete, the amount retained by the Owner shall be reduced to five percent (5%) provided that the Architect approves the Application for Payment, the Contractor is making, satisfactory progress and there is no specific cause for greater withholding. Notwithstanding the foregoing, the Owner may continue to withhold ten percent (10%) of the amount due the Contractor after the Project is fifty percent (50%) completed if the Architect provides written notification to the Owner of a specific cause for greater withholding or if the Owner determines in its sole and absolute discretion that there is a specific cause for greater withholding. A specific cause for greater withholding shall include, without limitation, the following:

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

.2 The existence of a dispute between the Owner and the Contractor regarding increased costs claimed

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by such Contractor; or

.3 A Contractor's failure to complete the Work in accordance with the Contract Documents, including, without limitation, the Drawings and Specifications, etc.

§ 9.3.6.1 In addition to the Owner's right to determine if a specific cause for greater withholding exists under Paragraph 9.3.6, the Architect shall be entitled to determine if a specific cause for greater withholding exists under this Paragraph 9.3.6.1. The Architect shall reject the reduction in retainage if the Contractor is not making satisfactory progress in its Work or if the Architect determines that there is a specific cause for greater withholding. The Architect will consider the following items when reviewing a request for reduction in retainage and failure to meet any of the following requirements may be considered by the Architect as sufficient grounds for rejecting a reduction of retainage:

.1 Satisfactory performance of the Work.
.2 Satisfactory maintenance of the Project schedule.
.3 Proper manning of the Project.
.4 Satisfactory completion of the Work.
.5 Satisfactory organization of the Project.
.6 Proper organization and coordination of subcontractors.
.7 Proper coordination with other Prime Contractors.
.8 All defective Work has been remedied or is in the process of being remedied.
.9 Work completed is not in contention.
.10 Satisfactory follow through of paperwork, certified payrolls, Change Order proposals, or Construction Change Directives.

The Architect's decision to reject a reduction of retainage shall be final and binding on the Contractors.

§ 9.3.7 If a specific cause for greater withholding does not exist, sum or sums withheld by the Owner from the Contractor after the Project is fifty percent (50%) completed shall not exceed five percent (5%) of the value of completed Work based on monthly progress payment requests.

§ 9.3.7.1 In the event a dispute arises between the Owner and a Contractor, the Owner shall have the option as it deems necessary, in its sole and absolute discretion, to either continue to withhold ten percent (10%) of the amount due the Contractor or to withhold additional retainage over and above the amount already retained by the Owner in the sum of one and one-half (1.5) times the amount of any possible liability until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the Contractor causing the additional claim furnishes a bond satisfactory to the Owner to indemnify the Owner against the claim.

§ 9.3.8 The Architect shall make final inspection within ten (10) days of receipt of the Contractor's request for final inspection and Application for Final Payment. If the Work is substantially completed and all other obligations have been met, the Architect shall issue a Certificate of Completion and a final Certificate for Payment and the Owner shall make payment in full within forty-five (45) days thereafter, less only one and one-half (1.5) times such amount as is required to complete any then remaining, uncompleted, minor items, which amount shall be certified by the Architect and upon receipt by the Owner of any guarantee bonds which may be required, in accordance with the Contract Documents, to insure proper workmanship for a designated period of time. The certificate given by the Architect shall list in detail each and every uncompleted item and a reasonable cost of completion.

§ 9.3.9 Final Payment of any amount so withheld for the completion of the minor items shall be paid thirty (30) days after written notice by the Contractor or thirty (30) days after written verification of completion of said items by the Architect/Engineer, whichever is later.

§ 9.3.10 If Final Payment due the Contractor for the Owner after Final Completion of the Contract is not paid within thirty (30) days of written notice, except for amounts disputed in good faith by the Owner, then the Contractor shall be entitled to interest at a rate of two percent (2%) per annum.

§ 9.3.11 All Applications for Payment are material and therefore the representations made by figures, language and documentation are material and the Contractor understands that the Owner is relying on those representations.

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§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, or notify the Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Architect shall forward such notification to the Contractor no later than the date established for such progress payment to the Contractor as set forth in the Contract Documents.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that the Work has progressed to the point indicated and that the 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 results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and 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 money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

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

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims;
- **.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 a separate contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- **.7** failure to carry out the Work in accordance with the Contract Documents; or
- **.8** failure to submit Wage Certifications as required by the Department of Labor and Industry.

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

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

§ 9.5.4 If the Contractor disputes any determination by the Architect with regard to any Certificate of Payment, the Contractor shall nevertheless expeditiously continue to prosecute the Work.

§ 9.6 PROGRESS PAYMENTS

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

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shall not constitute approval or acceptance of any item of cost in the Application for Payment. No partial payment made hereunder shall be or be construed to be final acceptance or approval of that portion of the Work to which such partial payment relates or relieve the Contractor of any of its obligations hereunder with respect thereto.

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

§ 9.6.2.1 The Contractor shall, at the request of the Owner or the Architect, prior to the submission of an Application for Payment, submit an affidavit signed by the Contractors, Subcontractors', manufacturers and/or suppliers that they have been paid for their portion of the Work from previous Applications for Payment.

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

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

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

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

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

§ 9.7 FAILURE OF PAYMENT

If the Owner does not pay the Contractor within twenty-one (21) days after the date established in the Contract Documents the amount certified by the Architect or awarded by a nonappealable order from a court of competent jurisdiction, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received.

§ 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 , and the local authority having jurisdiction has issued an approval based on Code Inspections so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.1.1 A condition precedent to Substantial Completion will be the Architect's receipt of the Contractor's notification for Substantial Completion inspection and the Architect's inspection of the Project.

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

§ 9.8.2.1 The Architect will verify the list provided by the Contractor and the Architect will, within fourteen (14)

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days after the receipt of the Contractor's notification for Substantial Completion, issue a list of any additional items to be completed or corrected. Should the Contractor fail to include its listing of Work that needs to be completed or corrected, the Architect will not be obligated to inspect the Project until such list is provided.

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

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, 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.

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

§ 9.9 PARTIAL OCCUPANCY OR USE

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

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

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

§ 9.9.4 As portions of the Project are completed, and occupied, the Contractor shall ensure the continuing construction activity will not unreasonably interfere with the use, occupancy and quiet enjoyment of the completed portions thereof.

§ 9.9.5 The Contractor agrees to coordinate the Work with the Owner in order to minimize disturbance to occupied portions of the structure. In the event performances or tests are conducted in close proximity to the Work in progress, the Contractor agrees to cease all Work which may disturb the Owner's occupants at the site.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and

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that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect 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 Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed 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 prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.3.1 If more than one (1) inspection for Final Completion is required, the Contractor will be billed and responsible for the professional fees and services of the Architect. Following Substantial Completion, in the event the Contractor or its Subcontractor fails to complete the list of items of the Work instructed by the Architect to be corrected or completed within the time period set forth elsewhere in the Contract Documents or if no such time period is set forth elsewhere in the Contract Documents, then within fourteen (14) days after the date of Substantial Completion, the Owner may: (i) exercise any available remedies to correct or complete deficient Work or retain a third party to correct or complete such Work at the cost of the defaulting Contractor; and (ii) retain and deduct from any payments or retention otherwise due to the defaulting Contractor any fees and expenses for services required to be provided by the Architect more than twenty-one (21) days after the date of Substantial Completion, and (iii) recover against the Contractor and Surety under the Performance Bond and Payment Bond, as part of its damages any and all legal fees and professional fees, jointly and severally, and all other costs and expenses incurred by the Owner in connection with the Owner's pursuit of its rights under the Performance Bond and Payment Bond, including, but not limited to, any and all legal fees, professional fees and all other costs and expenses related thereto. The Owner shall have the right to set off said amounts against any amount alleged to be due and owing to the Contractor on the base amount of the Contract.

§ 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.

§ 9.11 LIQUIDATED DAMAGES

§ 9.11.1 The Contractor and Contractor's Surety shall be jointly and severally liable for and shall pay the Owner the cost of expenses incurred by the Owner resulting from the Contractor's delay in completing the Work of the Contract within the Contract Time, as liquidated damages, and not as a penalty, in the amount of Five Hundred Dollars ($500.00) per calendar day, for each calendar day of delay until the Work is substantially complete at each phase of construction, subject to adjustments of the Contract Time as provided in the Contract Documents.
In addition to the foregoing and without limiting the foregoing, the Contractor and Contractor's Surety shall be jointly and severally liable for and shall pay the Owner the cost of expenses incurred by the Owner resulting from the Contractor's delay in submitting Shop Drawings, Product Data, Samples and similar submittals beyond the

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required number of days specified for such submittals as provided in the Contract Documents as liquidated damages, and not as a penalty, in the amount of Five Hundred Dollars ($500.00) per calendar day, for each calendar day of delay until such submittal has been properly submitted as provided in the Contract Documents. All submittals shall be received from the Contractors by the earlier of the date set forth in the Contract Documents, if applicable, or within fourteen (14) days of the Notice to Proceed.

In the event the Contractor or Surety litigates the validity of this provision or the assertion of liquidated damages, the Contractor and Surety, jointly and severally, shall also be liable for legal fees, professional fees, costs, other expenses and/or damages incurred by the Owner. This liquidated damages provision applies to each phase of construction. Owner's right to receive liquidated damages shall be in addition to all other rights and remedies available to the Owner at law or in equity.

§ 9.11.2 If any Contractor shall be responsible in the opinion of the Owner or the Architect, for delay in the actual time of completion of any other Contractor employed by the Owner in performance of any other portion of the Project, then the Contractor so determined to be responsible shall be liable for and shall pay to the Owner all liquidated damages otherwise attributable to such other Contractor, as well as any legal fees, professional fees, or other costs or expenses incurred by the Owner.

§ 9.11.3 The Owner shall have the right to deduct the total amount of liquidated damages for which the Contractor may be liable under this Article from any payments then or thereafter due the Contractor.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Owner and Architect within three (3) days after the receipt of the Notice to Proceed.

§ 10.1.1 Prior to performing any Work on the Project site, the Contractor shall submit to the Owner and Architect its Project Safety and Health Program fully describing the Contractor's commitments for meeting its obligations to provide safe and healthy working conditions for its employees, and generally contribute and enhance safety at the Project site. The Contractor's program shall reference federal and state OSHA standards and other rules and regulations applicable to construction activities on the Project. The Contractor's Project Safety and Health Program shall include, without limitation, as a minimum, the following:

.1 New Hire Safety and Orientation Program: Each new or reassigned employee of the Contractor shall receive a thorough safety orientation including, but not limited to, employer/employee responsibilities under federal/state OSHA regulations, ear protection in high noise level areas, respiratory protection, Material Safety Data Sheets (MSDS), fire protection, first aid facilities, and look-out procedures on electrical equipment. Attendance at the New Hire Safety and Orientation Program meeting is required and records must be kept on file in the Contractor's office for review.

.2 Weekly Tool Box Safety Meetings: The Contractor shall conduct Weekly Tool Box Safety Meetings to provide employees with current safety information. Attendance is required and records must be kept on file in the Contractor's office for review.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

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

.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors;

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

.4 construction or operation by the Owner or other Contractors.

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

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§ 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. The Contractor shall also be responsible, at the Contractor's sole cost and expense, for all measures necessary to protect any property adjacent to the Project and improvements therein. Any damage to such property or improvements shall be promptly repaired by the Contractor responsible.

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

§ 10.2.4.1 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary, the Contractor shall give the Owner reasonable advance notice.

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

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

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

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If the Contractor suffers injury or damage to person or property because of an act or omission of another party, written notice of such injury or damage, whether or not insured, shall be given to the Owner and Architect within a reasonable time not exceeding 21 days after discovery otherwise such claim shall be waived. The notice shall provide sufficient detail to enable the other party to investigate the matter. The Owner shall not be responsible for actions or inactions of other Contractors. Notwithstanding any provision of the Contract Documents to the contrary, no applicable statute of limitations for the Owner shall be deemed to have commenced with respect to any portion of the Work which is not in accordance with the requirements of the Contract Documents, which would not be visible or apparent upon conducting a reasonable investigation and which is not discovered by the Owner. In such instances, any applicable statute of limitations shall be deemed to have commenced on the date of actual discovery by the Owner. The statute of limitations for the Contractor shall be either one (1) year commencing on the date of Substantial Completion and shall expire one (1) year from the date of Substantial Completion or shall be one (1) year commencing on the date of the alleged breach and expiring one (1) year after the alleged breach, whichever is earlier.

§ 10.2.9 The Contractor shall furnish four (4) sets of Material Safety Data Sheets (MSDS) to the Owner for all materials used on the Project in accordance with government requirements. In addition, the Contractor shall maintain one (1) set of MSDS on the Project site for periodic inspection by the Owner. The Contractor shall be responsible for compliance with OSHA and the Hazard Communications Standard.

§ 10.3 HAZARDOUS MATERIALS

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

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notice of such material or substance the Owner will take necessary measures to have the material tested and/or removed as is appropriate to the condition. If any such material or substance is confirmed to cause foreseeable bodily injury or death to persons, the Contractor's sole remedy shall be to request an extension of the Contract Time, if permitted under Paragraph 8.3.1.

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

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

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

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's sole negligence.

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

§ 10.4 EMERGENCIES

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 From signing of the Agreement until thirty (30) days after Final Payment (except as otherwise noted below), the Contractor shall at its own expense, purchase and maintain insurance in companies properly licensed to do business in the Commonwealth of Pennsylvania and have an A- or better, or financial rating of IX or better with the A.M. Best's Company Key Rating, Guide Latest Edition and being, satisfactory to Owner and Architect, and which are licensed to practice business in the Commonwealth of Pennsylvania. The Contractor shall obtain insurance for protection from claims under workers' compensation acts and other employee benefits acts which are applicable, claims for damages because of bodily injury, including, without limitation, death, and claims for damages, other than to the Work itself, to property which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by the Contractor or by a Subcontractor or anyone directly or indirectly employed by any of them.

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§ 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 the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents. Insurance shall be carried with companies which are financially responsible. If any such insurance is due to expire during the construction period, the Contractor shall not permit the coverage to lapse and shall furnish evidence of continued coverage to the Owner and the Architect for record. The minimum coverage limits set forth herein shall be subject to periodic review, and Owner reserves the right to require that the Contractor increase the minimum coverage limits if, in the reasonable opinion of Owner, the minimum coverage limits become inadequate.

§ 11.1.2.1 Workmen's Compensation including, without limitation, Occupational Disease and Employer's Liability Insurance:

.1 Statutory Amounts and coverage as required by Commonwealth of Pennsylvania Workmen's Compensation laws.

.2 Employer's Liability at least $1,000,000 each accident; $1,000,000 disease policy limits; $1,000,000 disease each employee.

.3 Waiver of Subrogation in favor of Owner, when permitted by State law.

§ 11.1.2.2 Public Liability including, without limitation, coverage for direct operations, sublet work, personal and advertising injury, bodily injury, property damage with explosion, collapse, and underground hazard coverage (X, C, U) contractual liability, products and completed operations with limits not less than those stated below.

.1	General Aggregate (Other than Products and Completed Operations)	$2,000,000
.2	Products and Completed Operations Aggregate	$2,000,000
.3	Per Project Aggregate	$2,000,000
.4	Personal and Advertising Injury	$1,000,000
.5	Each Occurrence	$1,000,000

.6 Products and Completed Operations Insurance shall be maintained for a minimum period of three (3) years after final payment and the Contractor shall continue to provide evidence of such coverage to the Owner on an annual basis during the aforementioned period.

§ 11.1.2.3 Comprehensive Automobile Liability Insurance including, without limitation, coverage for owned, non-owned, and hired vehicles with limits not less than those stated below.

.1 Bodily Injury and Property Damage Combine
Each Occurrence $1,000,000

§ 11.1.2.4 Umbrella Excess Liability Policy written on an excess basis with minimum coverage limits not less than $2,000,000 for each occurrence and $2,000,000 in the aggregate which provides excess coverage over all underlying insurance policies. The Umbrella Excess Liability Policy shall include, without limitation, a follow form aggregate provision.

§ 11.1.2.5 Contractor's Pollution Liability Policy: $1,000,000 each loss, $1,000,000 aggregate coverage to be provided for pollution claims resulting from the operations of the Contractor and any Subcontractors, as well as any materials or supplies brought onto the jobsite. Policies to include coverage for Bodily Injury, Property Damage, and Cleanup Costs. Including Mold Coverage and Asbestos Coverage.

§ 11.1.2.6 The Contractor shall provide a Certificate of Insurance, **naming the Owner, County of Berks, its elected officials, agents, and employees, and the Architect, as additional insureds for "ongoing operations" and "products and completed operations" for a period of three years after final payment under the Commercial General Liability Coverage. Coverage should be provided by ISO Endorsements CG20 10 07 04 and CG2037 07 04 or their equivalent. Contractor's Commercial General Liability and Umbrella/Excess Policy shall be Primary to and will not require contribution from any other insurance under which the Additional Insured is a Named Insured. To the fullest extent permitted by applicable state law, all policies shall contain a Waiver of Subrogation Clause.**

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§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. 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. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

If this insurance is written on the Comprehensive General Liability policy form, the Certificates shall be AIA Document G705, Certificate of Insurance. If this insurance is written on a Commercial General Liability policy form, ACORD Form 25S will be acceptable.

§ 11.1.3.1 Each Contractor shall submit to the Owner within seven (7) days of the Notice of Intent to Award, an appropriate Certificate of Insurance which certifies that the Contractor is covered by insurance requirements of Article 11, Subparagraphs 11.1.2.1 through 11.1.2.5. Further, each Contractor fully understands that failure to timely submit the Certificate of Insurance shall give the Owner the option to withdraw the award, and forfeit the Bidder's Bid Bond.

§ 11.1.4 The Contractor shall furnish three (3) copies of Certificates of Insurance herein required; furnish three (3) copies of any endorsements that are subsequently issued amending coverages or limits; and furnish three (3) copies of Certificates of Insurance at time of policy renewal indicating such renewal. The Certificates of Insurance shall set forth evidence of all coverages required by the Contract Documents, and shall specifically certify that the coverage afforded under these policies will not be canceled, non renewed, materially changed, or the limits reduced without a minimum of thirty (30) days prior written notice, by certified mail, to the Owner. Failure to furnish the correct types of insurance on the correct forms in the correct amounts shall constitute a material breach of the conditions for award of the Agreement and the Contractor shall be deemed to be in default.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 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 written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis. 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 9.10 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 later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project. The Owner shall purchase builder's risk insurance for the Project, which insurance will provide coverage for the Contractor's interest in its portion of the Work completed as well as any material of the Contractor physically located on the Project site which will become a permanent part of the building. Furthermore, each Contractor shall be solely liable for paying the deductible on the Owner's builder's risk insurance for the Project for any claims relating to such Contractor's Work. The Owner's builder's risk insurance deductible will be $5,000.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 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 affect insurance that will protect the interests of the

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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 in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the Contractor stores work offsite, the Contractor shall provide insurance coverage for portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the Work in transit.

§ 11.3.1.4 The Owner and the Contractor intend that policies provided in response to these provisions shall protect all of the parties insured and provide primary and non-contributory coverage for losses and damages caused by the perils covered thereby. Accordingly, such policies shall state that in the event of payment of loss or damage, the insurer shall have no right of recovery against the parties named as insureds or additional insureds. In addition, all of the Contractor's insurance policies and the Certificates of Insurance shall state that such insurance is primary and non-contributory with respect to any other valid and collectible insurance policies.

§ 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, 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 other special causes of loss 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, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss 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, and that its limits will not be reduced, 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 (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, 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

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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 the 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 mortgagee 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 as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 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 is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds shall be obtained from a company acceptable to the Owner and authorized to transact business in the Commonwealth of Pennsylvania, and the cost thereof shall be included in the Contract Sum. The amount of each Payment Bond and Performance Bond shall be equal to one hundred percent (100%) of the Contract Sum. All Payment and Performance Bonds shall be on the County specified forms included with this contract.

The insurance carriers from whom the Contractor has purchased bonds must be listed in the most recent U.S. Treasury Department Circular and the amount of said bonds in question must not exceed the acceptable limit therein recommended for bonds.

§ 11.4.2 The Contractor shall deliver the required Payment Bond and Performance Bond to the Owner not later than seven (7) days after receipt of Notice of Intent to Award.

§ 11.4.3 The Contractor shall require the attorney-in-fact who executes the required Payment Bond and Performance Bond on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

§ 11.4.4 If a Contractor fails to deliver a Payment Bond and Performance Bond in the amounts and types required, in accordance with Paragraph 11.4.1, the Owner may declare the Contractor in default and may award the Contract to the next lowest responsive, responsible bidder and require, among other things, surrender of the Bid Bond by such Contractor. All bonds required by the Contract Documents must involve insurance providers that are licensed and authorized to conduct business in the Commonwealth of Pennsylvania.

§ 11.5 INSURANCE CARRIERS

§ 11.5.1 If any party is damaged by the failure of the other to purchase or maintain insurance required under Article 11 and so notifies the other party, then the party who failed to purchase or maintain the insurance shall bear all reasonable costs properly attributable thereto.

§ 11.5.2 Whenever the Contractor is required under these Contract Documents to furnish insurance coverage, all policies of insurance so furnished shall be issued by an insurance company or by insurance companies licensed to do business in the Commonwealth of Pennsylvania.

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ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

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

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of 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. The Owner shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.1.1 Work that is rejected or fails to conform to the requirements of the Contract Documents that requires any review, research, recommendation, meetings or direction by the Architect, or any other consultants in order to substantiate the same or to approve remedies or alternate solutions will be subject to Paragraph 12.2.2. The Architect and any consultant will be compensated for such additional Work at the prevailing rates by the Owner, who will be entitled to back charge the responsible Contractor for such fees, as well as any legal fees, professional fees, other expenses or costs incurred. The Owner may deduct the same from any Application for Payment or any amount of retainage.

§ 12.2.2.1.2 If prior to the date of Substantial Completion, the Contractor, a Subcontractor or anyone for whom either is responsible uses or damages any portion of the Work, including, but not limited to, mechanical, electrical, plumbing and other building systems, machinery, equipment or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

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

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

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

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for

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correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.2.6 Nothing contained in this Paragraph shall decrease the responsibilities set forth in the Performance Bond.

§ 12.2.6.1 The obligations under Paragraph 12.2 shall cover any repairs and replacement to any part of the Work or other property caused by the defective Work.

§ 12.2.6.2 Upon completion of any Work under or pursuant to this Paragraph 12.2.2 and its subparagraphs, the one (1) year correction period in connection with the Work requiring correction shall be renewed and recommence.

§ 12.2.6.3 The Contractor will be responsible for any expense of the Owner incurred by said uncovering or repair including, but not limited to, legal fees, professional fees, other expenses or costs.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the laws of the Commonwealth of Pennsylvania, without regard to principles of conflicts of law. All actions shall be settled in a non-jury trial and shall be brought in the Court of Common Pleas of Berks County, Pennsylvania.

§ 13.2 SUCCESSORS AND ASSIGNS

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

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

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to 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 or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.3.1 Written notice shall be deemed to have been duly served on the Owner if delivered in person or sent by Registered or Certified Mail to the following:

.1 Christine M. Sadler, Esq.
Berks County Solicitor
County of Berks
County Services Center
633 Court Street, 13th Floor
Reading, PA 19601

§ 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, 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 there under, except as may be specifically agreed in writing.

§ 13.4.3 In the event the Contractor should breach any obligations imposed by the Contract Documents, in addition to all other damages, losses, costs and relief, whether in law or equity, which the Owner may recover the Owner shall also be entitled to an award for any reasonable legal fees incurred in attempting to enforce or recover under the Contract Documents by reason of the Contractor's breach. The Owner's right to recover under the Contract Documents, at law or in equity shall not be restricted to the rights and remedies set forth In Article 15 of these General Conditions.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs, including, without limitation, the cost of retesting for verification of compliance if necessary, until the Architect certifies that the Work in question does comply with the requirements of the Contract Documents, and all such costs shall not be included in computing the Contract Sum of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor. At the Owner's option, the Owner may retain a field testing agency for this project or other testing agencies, as the Owner deems necessary, in its sole discretion.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense. At the Owner's option, the Owner may retain a separate entity to perform the additional testing, inspection or approval not included under Section 13.5.1.

§ 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, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense. Such amounts will be deducted, to the extent available, from any amount due such Contractor. If the amount due the Contractor is not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner within seven (7) days of receipt of the Owner's invoice for such legal fees, professional fees or other cost or 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 Architect.

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

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

§ 13.6 INTEREST

Final Payment due and unpaid under the Contract Documents, except for amounts disputed in good faith by the Owner, shall bear interest from the date payment is due at the rate of two percent (2%) per annum.

§ 13.7 TIME LIMITS ON CLAIMS

As between the Owner and Contractor:

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.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;

.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; and

.4 Latent Defects: Nothing herein contained shall be deemed to have caused any applicable statute of limitations to commence to run or any alleged cause of action to have accrued in the event of any latent defect not discovered until after the issuance of the final Certificate for Payment. The statute of limitations shall commence to run on any alleged latent cause of action only upon actual discovery of such latent defect.

§ 13.8 INTERPRETATIONS

§ 13.8.1 Where required hereunder to effectuate the intent of the Contract Documents, masculine shall mean neuter or feminine and the singular shall mean the plural.

§ 13.8.2 The captions and headings of various Articles and Paragraphs in the Contract Documents are for convenience only and are not to be construed as defining or limiting, in any way, the scope or intent of the provisions hereof.

§ 13.8.3 The invalidity of any covenant, restriction, condition, limitation or any other part or provision of the Contract Documents shall not impair or affect in any manner the validity, enforceability or effect of the remainder of the Contract Documents.

§ 13.9 EMPLOYMENT POLICIES

§ 13.9.1 The Contractor shall maintain policies of employment as follows:

§ 13.9.1.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising; lay-off or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of nondiscrimination.

§ 13.9.1.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

§ 13.10 CONSTRUCTION OF THIS AGREEMENT

§ 13.10 The parties hereto acknowledge that all of them have participated in the drafting of the Contract Documents and the parties hereto expressly waive the defense of contra proferentum, i.e., that the Contract Documents or any portion of the Contract Documents may be construed against any party as the drafter thereof.

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ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 If the Work is stopped for a period of sixty (60) consecutive days under final, nonappealable order of any court or other public authority having jurisdiction, through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons or entities performing portions of the Work under the Contract with the Contractor, then the Contractor may, upon fourteen (14) days written notice to the Owner and the Architect, terminate the Contract and recover from the Owner payment of all Work properly executed. In such event, the Contractor shall be entitled to payment for Work performed at the site only. This is the Contractor's sole remedy. If the Contractor challenges termination, the Contractor will forfeit its right to recover payment under this Paragraph and will be responsible for all of the Owner's costs including, but not limited to, legal fees, professional fees and other expenses and costs.

14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** 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** disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker 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** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract. The costs of finishing the Work shall include, but not be limited to, all reasonable legal fees, professional fees, additional title costs, insurance, additional interest because of any delay in completing the Work, and all other direct and indirect consequential and/or incidental costs incurred by the Owner by reason of the termination of the Contractor as stated herein.

§ 14.2.5 In the event of termination for cause, the Owner may assess the responsible Contractor legal fees, professional fees, costs and expenses including, but not limited to, employee time attributable to said event, and the Contractor shall immediately reimburse the Owner for the same. In the event that any Contractor fails to adhere to a contractual provision or other requirements of the Contract Documents, whether the subject provision is material or not, to the extent the Owner incurs legal fees, professional fees, costs or expenses, of any kind in the Owner's attempt to enforce such provisions, the Contractor shall be liable to the Owner for the same. In such event, the Owner may deduct such amounts from any Application for Payment, retainage or otherwise invoice the Contractor.

§ 14.2.6 Notwithstanding any other provision of the Contract Documents to the contrary, in the event that the Contractor abandons its Work on the Project, as determined by the Owner in its absolute discretion, and the Contractor does not resume its Work on the Project after seven (7) days prior written notice from the Owner, then the Contractor shall be deemed automatically terminated for cause and such termination for cause shall not require

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consultation or certification by the Architect. The Owner's rights set forth in this Paragraph 14.2.6 shall be in addition to all other rights of the Owner granted in the Contract Documents, at law, or in equity.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

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

§ 14.3.2 The Contract Time shall be adjusted for increases in the time caused by suspension, delay or interruption as described in Section 14.3.1. No adjustment shall be made to the extent:

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

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

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

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

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

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

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

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

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner for Work performed by the Contractor in accordance with the Contract Documents. The Contractor shall not be entitled to receive any other compensation, including, without limitation, for field and office overhead or profit (e.g. expected or actual profit), termination expenses or damages.

§ 14.4.4 In the event the Owner elects to terminate the Contractor for cause, the Owner may recover against the Contractor and Surety as part of its damages any and all legal fees, professional fees, jointly and severally, including, but not limited to, architectural fees, construction management fees, legal fees, and all other costs and expenses related thereto. The Owner shall have the right to set off said amounts against any amount alleged to be due and owing to the Contractor on the base amount of the Contract. Further, should the Contractor fail to achieve Final Completion promptly, upon written recommendation by the Architect and upon notice to the Contractor and after reasonable opportunity to cure, the Owner may, for cause, terminate the Contractor, complete the Work, and recover against the Contractor or Surety, any and all amounts that the Owner incurs, including, but not limited to, any and all legal fees, professional fees and all other costs and expenses related thereto.

§ 14.4.5 In the event that the Owner declares the Contractor in default and the Contractor's Surety fails to adhere to its obligations under the Performance Bond and Payment Bond the Surety shall be liable to the Owner for any and all damages that the Owner incurs including, but not limited to, any legal fees, professional fees, or other costs or expenses incurred by the Owner in connection with the Owner's pursuit of its rights under the Performance Bond, Payment Bond and/or applicable law, including, but not limited to, the cost of all litigation, legal fees, professional fees, and all other costs and expenses.

§ 14.4.6 To the extent any Contractor sues the Owner and the Contractor does not prevail entirely in such litigation, the Contractor shall be responsible for all of the Owner's damages including, but not limited to, any and all legal fees, professional fees and all costs and expenses related thereto.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, 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. The responsibility to substantiate Claims shall rest with the party making the Claim.

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§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

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

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

§ 15.1.5.3 Construction Acceleration Claims

No claim for an increase in the Contract Sum or change in the Contract Time shall be based on construction acceleration. Accordingly, no course of conduct or dealings between the parties, or any express or implied statements made by the parties, nor any express or implied acceptance of alterations to the Work, and no claim that the Owner has been unjustly enriched by any alteration or addition to the Work, whether or not there is in fact any such unjust enrichment, shall be the basis for any claim to an increase in the Contract Sum or change in the Contract Time.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL AND/OR INCIDENTAL DAMAGES

The Contractor waives claims against the Owner for consequential and/or incidental damages arising out of or relating to this Contract. This waiver includes, but is not limited to:

.1 Consequential damages incurred by the Contractor for principal office expenses including but not limited to, the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of actual and expected profits.

.2 Incidental damages incurred by the Contractor including, but not limited to costs resulting from stopping the Work, removing and transporting the Contractor's property (e.g. the Contractor's equipment, supplies and materials) from the Project site, and storing the Contractor's property (e.g. the Contractor's equipment, supplies and materials) at an alternate location.

This waiver is applicable, without limitation, to all consequential and/or incidental damages due to either the Contractor and/or the Owner's termination in accordance with Article 14.

§ 15.1.7 CLAIMS FOR ECONOMIC LOSS

The Contractor shall have no claim or right of recovery of damages against the Owner and/or the Architect for economic loss sustained, in whole or in part, by any act or omission of the Owner and/or the Architect to the extent that such act or omission constitutes a breach of contract. Specifically, and without limiting the generality of the foregoing, the Contractor shall have no claim against the Owner or the Architect for economic loss based upon any tort, including, without limitation, negligence, negligent misrepresentation or any other tort-based theory of liability.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise

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indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to any dispute resolution proceedings relating to any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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

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

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

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

§ 15.2.6 When a written decision of the Architect states that (1) the decision is final but subject to litigation and (2) filing of a lawsuit or a claim covered by such decision must be made by the

Contractor within thirty (30) days after the date on which the Contractor receives the final written decision, then the Contractor's failure to file suit within said thirty (30) days' period shall result in the Architect's decision becoming final and binding upon the Contractor. If the Architect renders a decision after litigation proceedings have been initiated, such decision may be entered as evidence, but shall not supersede litigation proceedings unless the decision is acceptable to all parties concerned.

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

§ 15.3 LITIGATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.5 and 15.1.6 shall be brought in the Court of Common Pleas of Berks County, Pennsylvania.

§ 15.3.2 To the extent the Contractor pursues a claim or litigation against the Owner and the Owner prevails, partially or completely, on any or all of its own claims or defenses to the Contractor's claims, leaving the Contractor with less than one hundred percent (100%) recovery, the Contractor will be liable for any and all legal fees, professional fees, costs or expenses of the Owner, as well as the true cost of any of the Owner's employees' time, associated with analyzing any claim, pursuing litigation or defending the claim or litigation. Further, to the extent any Contractor makes an excessive number of claims, which excessiveness, shall be determined solely in the discretion of the Owner, and the Owner incurs any legal fees, professional fees, expenses, costs (including, but not limited to, employee cost), the Contractor shall be liable for such fees, expenses or costs.

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§ 15.3.3 In the event of a dispute between the Contractor and the Owner, to the extent that the Owner incurs any legal fees, professional fees, or other costs or expenses, the Contractor will be responsible for those amounts, which will be deducted, to the extent available, from any amount due the Contractor. If the amount due the Contractor is not sufficient to cover such cost, the Contractor shall pay the difference to the Owner within seven (7) days of receipt of the Owner's invoice for such legal fees, professional fees, or other cost or expenses.

ARTICLE 16 STATUTORY REQUIREMENTS

§ 16.1 The Contractor's attention is directed to the fact that all applicable Federal and State laws, Municipal ordinances, the School Code, and the rules and regulations of all authorities having jurisdiction over construction of the Project shall apply to the Agreement throughout, and they are deemed to be included in the Agreement the same as though herein written in full.

§ 16.2 HUMAN RELATIONS ACT

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

§ 16.3 PENNSYLVANIA PREVAILING WAGE ACT

§ 16.3.1 Pennsylvania Prevailing Wage Act (Act No. 442 of 1961, P.L. 987, amended by Act 342 of 1963, P.L. 653), and as amended from time to time (43 P.S. Section 165-1, et seq.). The Pennsylvania Prevailing Wage Act, the regulations thereto, and the Prevailing Minimum Wage Determination Schedule, 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 the Work is performed, are made part of these General Conditions.

§ 16.3.2 No person shall be employed to Work under this Contract except competent and first-class workers and mechanics. No workers shall be regarded as competent and first-class except those who are duly skilled in their respective branches of labor, and who shall be paid not less than such rates of wages and for such hours as established by the Secretary of the Department of Labor and Industry under the "Pennsylvania Prevailing Wage Act" (Act No. 442), effective February 1, 1962, amended by Act 342 of 1963, P.L. 653 and as amended from time to time.

§ 16.3.3 The general prevailing minimum wage rates including contributions for employee benefits as determined by the Secretary shall be paid to the workers employed in the performance of the Contract.

§ 16.3.4 The Contractor shall pay no less than the wage rates as determined in the decision of the Secretary of Labor and Industry and shall comply with the conditions of the Pennsylvania Prevailing Wage Act approved August 15, 1961 (Act No. 442), as amended August 9, 1963 (Act No. 342 of 1963, P.L. 653, and as amended from time to time), and the Regulations issued pursuant thereto, to assure the full and proper payment of said rates.

§ 16.3.5 All workers shall be paid no less than such general prevailing minimum wage rates and such other provisions to assure payment thereof as heretofore set forth in these General Conditions.

§ 16.3.6 The Contract provisions shall apply to all Work performed on the Contract by the Contractor and to all Work performed on the Contract by all Subcontractors.

§ 16.3.7 The Contractor shall insert into each subcontract all of the stipulations contained in these required provisions and such other stipulations as may be required.

§ 16.3.8 No workers shall be employed on the Project except in accordance with the classifications set forth in the decision of the Secretary. In the event that additional or different classifications are necessary, the procedure set forth in the Regulations shall be followed.

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

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

.1 Name of Project.

.2 Name of public body of which it is being constructed.

.3 The crafts and classifications of workers listed in Secretary's general prevailing minimum wage rate determination for the particular project.

.4 The general prevailing minimum wage rates determined for each craft and classification and the effective date of any changes.

.5 A statement advising workers that if they have been paid less than the general prevailing minimum wage rate for the job classification or that the Contractor and/or Subcontractor are not complying with the Pennsylvania Prevailing Wage Act or the Regulations in any manner whatsoever, they may file a protest in writing, with the Secretary, within three (3) months of the date of the occurrence, objecting to the payment to any Contractor to the extent of the amount or amounts due or to become due to them as wages for Work performed on the Project. Any workers paid less than the rate specified in the Contract shall have a civil right of action for the difference between the wage paid and the wages stipulated in the Contract, which right of action must be exercised within six (6) months from the occurrence of the event creating, such right.

§ 16.3.11 The Contractor and all Subcontractors shall keep an accurate record showing the time, craft and/or classification, number of hours worked per day, and the actual hourly rate of wage paid (including employee benefits) to each worker employed by them in connection with the Project and such record must include, without limitation, any deductions from each worker. The record shall be preserved for two (2) years from the date of payment and shall be open at all reasonable hours to the inspection of the Owner and to the Secretary or the Secretary's duly authorized representatives.

§ 16.3.12 Apprentices shall be limited to such numbers as shall be in accordance with a bonafide apprenticeship program registered with and approved by the Pennsylvania Apprenticeship and Training Council and only apprentices whose training and employment are in full compliance with the provisions of the Apprenticeship and Training Act effective as of June 1, 1961 (Act No. 304, P.L. 604), the Rules and Regulations issued pursuant thereto (43 P.S. Sec. 90.1, et seq.), as amended from time to time, shall be employed on the Project. Any workers using the tools of a craft who does not qualify as an apprentice within the provisions of the Apprenticeship and Training Act shall be paid the rate predetermined for journeymen in that particular craft and/or classification.

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

§ 16.3.14 Payment of compensation to workers for Work performed on the Project on a lump sum basis, or a piece work basis, or a price certain for the completion of a certain amount of Work, or the production of a certain result, shall be deemed a violation of the Pennsylvania Prevailing Wage Act and the Regulations, regardless of the average hourly earnings resulting therefrom.

§ 16.3.15 Each Prime Contractor and Subcontractor shall file a statement each week and a final statement at the conclusion of the Work on the Project with the Owner, under oath, and in form, satisfactory to the Secretary, certifying that all workers have been paid wages in strict conformity with the provisions of the Contract as prescribed in the Pennsylvania Prevailing Wage Act, and the Regulations thereto, or if any wages remain unpaid to set forth the amount of wages due and owing to each worker respectively.

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§ 16.4 CITIZENS

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

§ 16.5 SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

§ 16.5.1 The Contractor shall be fully informed of and shall comply with all local, state and federal regulations for construction as amended to date, as the rules and regulations in detail apply for the Work under the Contract. All applicable rules and regulations of governing bodies are hereby made a part of these General Conditions by reference, as if written out in full within.

§ 16.6 STEEL PRODUCTS PROCUREMENT ACT

§ 16.6.1 In accordance with Act 3 of the 1978 General Assembly of the Commonwealth of Pennsylvania, (March 3, 1978 P.L. 6), as amended from time to time (73 P.S. Section 1881, et seq.), every public agency shall require that every Contract Document for the construction, reconstruction, alteration, repair, improvement or maintenance of public works contain a provision that, if any steel products are to used or supplied in the performance of the Contract, only those steel products produced in the United States, as herein defined, shall be used or supplied in the performance of the Contract or any Subcontractors thereunder.

§ 16.6.2 "Public Works" are defined as any structure, building, highway, waterway, street, bridge, transit system, airport or other betterment, work or improvement whether of a permanent or temporary nature and whether for governmental or proprietary use. This term includes, but is not limited to, any railway, street railway, subway, elevated and monorail passenger or passenger and rail rolling stock, self-propped cars, gallery cars, locomotives, passenger buses, wires, poles and equipment for electrification of a transit system, rails, tracks, roadbeds, guideways, elevated structures, buildings, stations, terminals, docks, shelters and repairs to any of the foregoing.

§ 16.6.3 "Steel products" are defined as products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two (2) 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, 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 seventy-five percent (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. Transportation equipment shall be determined to be a United States steel product if it complies with Section 165 of Public Law 97-424 (96 Stat. 2136).

§ 16.6.4 "United States" are defined as the United States of America and include all territory, continental or insular, subject to the jurisdiction of the United States.

§ 16.6.5 In accordance with Act 161 of 1982 (June 18, 1982 P.L. 556) cast iron products shall also be included and produced in the United States. Act 144 of 1984 (July 9, 1984 P.L. 674) further defines "steel products" to include machinery and equipment. Act 142 of 1980 (Oct. 5, 1980 P.L. 693), Act 161 of 1982 and Act 141 of 1984 provide clarifications and penalties and the Contractor shall abide by these Acts, as amended from time to time.

§ 16.7 ANTI-POLLUTION LEGISLATION

§ 16.7.1 62 Pa. C.S.A. Section 3301 requires that Bidders on construction contracts, for the Commonwealth of Pennsylvania be advised that there are provisions of Federal and State statutes, rules and regulations dealing with the prevention of environmental pollution and the preservation of public natural resources that affect the Project on which Bids are being received.

§ 16.7.2 The Bidder shall become thoroughly acquainted with the terms of the listed statutes, rules and regulations, including, but not limited to, Flood Plain Management Act (32 P.S. Section 679.101, et seq.), Water Well Drillers License Act (32 P.S. Section 645.1, et seq.), Pennsylvania Scenic Rivers Act (32 P.S. Section 820.21, et seq.), Dam Safety and Encroachment Act (32 P.S. Sec. 693.1, et seq.), Bluff Recession and Setback Act (32 P.S. Section 5201, et seq.), Storm Water Management Act (32 P.S. Section 680, et seq.), Pennsylvania Sewage Facilities Act (35 P.S. Section 750.1, et seq.), Pennsylvania Solid Waste Management Act (35 P.S. Section 6018.101, et seq.),

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Pennsylvania Safe Drinking Water Act (35 P.S. Section 721.1, et seq.), the Clean Streams Law (35 P.S. Section 691.901 et seq. and 35 P.S. Section 691.1 et. seq.), Air Pollution Control Act (35 P.S. Section 4001, et seq.), Pennsylvania Historic Preservation Act (37 Pa. C.S.A. Section 501, et seq.), Pennsylvania Hazardous Sites Clean Up Act (35 P.S. Section 6020.101, et seq.), Pennsylvania Storage Tank and Spill Prevention Act (35 P.S. Sec. 6021.101, et seq.), Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. Sections 9601-9675) as amended, including, but not limited to, the Superfund Amendments and Reauthorization Act (P.L. 99-499), Federal Solid Waste Disposal Act (42 U.S.C. Sections 6901-6992), Federal Clean Air Act (Air Pollution Act) (42 U.S.C. Sections 7401-7642), Federal Safe Drinking Water Act (See Public Health Service Act Sections 1401-1451) (42 U.S.C. Sections 300f-300j-11), Wild and Scenic River Act (P.L. 90-542), Endangered Species Conservation Act of 1969 (P.L. 89-669), Endangered Species Conservation Act of 1973 (16 U.S.C. Sections 1531-1544), Federal Clean Water Act of 1977 (P.L. 95-217), Rivers and Harbor Act of 1970 (P.L. 91-611), Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. Sections 136-136y), Toxic Substance Control Act (15 U.S.C. Sections 2601-2692), Resource Conservation and Recovery Act of 1976 (42 U.S.C. Sections 6901-6991), Coastal Wetlands Planning, Protection and Restoration Act (16. U.S.C. Sections 3951-3956), Coastal Zone Management Act of 1972 (16 U.S.C. Sections 1451-1464), Community Environmental Response Facilitation Act (42 U.S.C. Section 9620), Emergency Planning and Right-to-Know Act of 1986 (42 U.S.C. Sections 11001-11050), Energy Supply and Environmental Coordination Act of 1974 (15 U.S.C. Sections 791-798), Environmental Quality Improvement Act of 1970 (42 U.S.C. Sections 4371-4375), Federal Facility Compliance Act of 1992 (42 U.S.C. Section 6901), Federal Land Policy and Management Act of 1976 (43 U.S.C. Sections 1701-1784), Federal Water Pollution Control Act (33 U.S.C. Sections 1251-1387), Geothermal Energy Research, Development, and Demonstration Act of 1974 (30 U.S.C. Sections 1101-1164), Global Climate Protection Act of 1987 (15 U.S.C. Section 2901 note), Hazardous Substance Response Revenue Act of 1980 (see 26 U.S.C. Sections 4611, 4612, 4661, 4662), Lead-Based Paint Exposure Reduction Act (15 U.S.C. Sections 2681-2692), Lead Contamination Control Act of 1988 (42 U.S.C. Sections 300j-21 to 300j-25), Low-Level Radioactive Waste Policy Act (42 U.S.C. Sections 2021b-2021d), National Climate Program Act (15 U.S.C. Sections 2901-2908), National Contaminated Sediment Assessment and Management Act (33 U.S.C. Section 1271 note), National Environmental Policy Act of 1969 (42 U.S.C. Sections 4321-4370b), National Ocean Pollution Planning Act of 1978 (33 U.S.C. Sections 1701-1709), Noise Control Act of 1972 (42 U.S.C. Sections 4901-4918), Oil Pollution Act of 1990 (33 U.S.C. Sections 2701-2761), Pollution Prevention Act of 1990 (42 U.S.C. Sections 13101-13109), Public Health Service Act (42 U.S.C. Sections 300f-300j-11), Renewable Resources Extension Act of 1978 (16 U.S.C. Sections 1671-1676), Resource Conservation and Recovery Act of 1976 (42 U.S.C. Sections 6901-6991), Soil and Water Resources Conservation Act of 1977 (16 U.S.C. Sections 2001-2009), Water Resources Research Act of 1984 (42 U.S.C. Sections 10301-10309), Wood Residue Utilization Act of 1980 (16 U.S.C. Sections 1681-1687), Pennsylvania Worker and Community Right-to-Know Act (35 P.S. Section 7301, et seq.), Asbestos Hazard Emergency Response Act of 1986 (see Toxic Substances Control Act Sections 201-214) (15 U.S.C. Sections 2651-2654), Delaware River Basin Compact (32 P.S. Section 815.101, et seq.), Brandywine River Valley Compact (32 P.S. Section 818, et seq.), Wheeling Creek Watershed Protection and Flood Prevention District Compact (32 P.S. Section 819, et seq.), Susquehanna River Basin Compact (32 P.S. Section 820.1, et seq.), Chesapeake Bay Commission Agreement (32 P.S. Section 820.11, et seq.), Land and Water Conservation and Reclamation Act (32 P.S. Section 5101, et seq.), Wild Resource Conservation Act (32 P.S. Section 5301, et seq.), Cave Protection Act (32 P.S. Section 5601, et seq.), Rails to Trails Act (32 P.S. Section 5611, et seq.), Phosphate Detergent Act (35 P.S. Section 722.1, et seq.), Plumbing System Lead Ban and Notification Act (35 P.S. Section 723.1, et seq.), Publicly Owned Treatment Works Penalty Law (35 P.S. Section 752.1, et seq.), Pennsylvania Solid Waste-Resources Recovery Act (35 P.S. Section 755.1, et seq.), Sewage System Cleaner Control Act (35 P.S. Section 770.01, et seq.), Hazardous Material Emergency Planning and Response Act (35 P.S. Section 6022.101, et seq.), Oil Spill Responder Liability Act (35 P.S. Section 6023.1, et seq.), Land Recycling and Environmental Remediation Standards Act (35 P.S. Section 6026.101, et seq.), Radiation Protection Act (35 P.S. Section 7110.101, et seq.), Low-Level Radioactive Waste Disposal Act (35 P.S. Section 7130.101, et seq.), Pennsylvania Municipalities Planning Code (53 P.S. Section 10101, et seq.), regulations, ordinances, and other actions pursuant to the foregoing, regulations pertaining to Pennsylvania Erosion and Sediment Control, and so on. No separate or additional payment will be made for such compliance. In the event that the listed statutes, rules and regulations are amended, or if new statues, rules or regulations become effective, after date of receipt of Bids, upon receipt of documentation which causes the Contractor to perform additional Work, the Owner may issue a Change Order setting forth the additional Work that must be undertaken and such additional Work shall be undertaken at no additional cost to the Owner. It is also the responsibility of the Contractor to determine what local ordinances, if any, will affect their portion of the Work. The Contractor shall check for any County, City, Borough or Township rules or regulations applicable to the area in which the Project is being constructed and, in addition, for any rules or regulations of other organizations having jurisdiction, including, without limitation, chambers of commerce, planning commissions, industries or utility companies who have jurisdiction over lands which the Contractor

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occupies. Any costs of compliance with local controls shall be included in the prices bid, even though documents of such local controlling agencies are not listed herein.

§ 16.8 EROSION CONTROL.

§ 16.8.1 Contractors performing excavation work shall comply with all rules and regulations of Chapter 102, Title 25 of Pennsylvania Soils Erosion and Sedimentation Control (25 Pa. Code Section 102.1, et seq.). Prior to any grading, the Contractor shall be responsible to obtain approval from the Department of Environmental Protection for an approved sedimentation and erosion control site plan and shall perform all necessary site work in accordance with said plan. The plan shall be available at the site at all times. Contractors performing excavation work shall maintain all devices as required to control erosion caused by storing water and preventing dust and particles from being distributed off site.

§ 16.8.2 Site Excavation: The Contractor shall:

.1 request the location and type of facility owner lines at the Project site by notifying the facility owner through the one call system as defined in 73 P.S. § 176. Notification shall be not less than three (3) business days nor more than ten (10) business days in advance of beginning excavation or demolition work. No work shall begin earlier than the scheduled excavation date which shall be on or after the third business day after notification. The scheduled excavation date shall exclude the date upon which notification was received by the one call system and notification received on a Saturday, Sunday or holiday, which shall be processed on the following business day. In the case of a complex project as defined in 73 P.S. § 176, notification shall not be less than ten (10) business days in advance of the beginning of excavation or demolition work.

.2 provide the one call system with specific information to identify the Project site so that facility owners might provide indications of their lines.

.3 take reasonable steps to work with facility owners including, without limitation, scheduling and conducting a preconstruction meeting, so that the Contractor may locate the facilities at a time reasonably in advance of the actual start of excavation or demolition work for each phase of the Work if the Project is a complex project as defined in 73 P.S. § 176 or if an excavation Contractor intends to perform work at multiple sites or over a large area. After commencement of excavation or demolition work, the excavation Contractor shall be responsible for protecting and preserving the staking, marking or other designation until no longer required for proper and safe excavation or demolition work at or near the underground facility, or by contacting the one call system to request that the facilities be marked again in the event that the previous markings have been compromised or eliminated.

.4 comply with the requirements established by the one call system as determined by the board of directors regarding the maximum area that a notification may cover.

.5 inform each operator employed by the excavation Contractor at the Project site of the information received with respect to location and type of underground installations and any other information required by 73 P.S. § 176, et. seq.

.6 report immediately to the Owner and the Architect, any break or leak on its lines or any dent, gouge, groove or other damage to such lines, to their coating or cathodic protection, made or discovered in the course of the excavation or demolition work.

.7 immediately notify 911 and the facility owner if the damage results in the escape of any flammable, toxic or corrosive gas or liquid which endangers life, health or property.

.8 assist a facility owner in determining involvement of a facility owner's lines by disclosing additional available information requested by the facility owner, including, without limitation, dimensions and the direction of proposed excavations.

.9 re-notify the one call system unless other arrangements have been made directly with the facility owners involved at the Project site if the excavation Contractor removes its equipment and vacates the Project site for more than two (2) business days.

.10 submit an incident report to the Department of Labor and Industry of the Commonwealth of Pennsylvania not more than ten (10) business days after striking or otherwise damaging a facility owner's line during excavation or demolition activities that resulted in personal injury or property damage to parties other than the affected excavation Contractor or facility owner.

.11 comply with all requests for information by the Department of Labor and Industry of the Commonwealth of Pennsylvania relating to such Department of Labor and Industry's enforcement authority under the 73 P.S. § 176, et. seq. within thirty (30) days of the receipt of the request.

.12 ensure the accuracy of the information provided to the one call system pursuant to 73 P.S. § 176, et.

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seq.

.13 become thoroughly acquainted with and comply with all other terms and conditions specified in 73 P.S. § 176, et. seq., as amended from time to time including, without limitation, the Contractor shall pay all applicable fees.

.14 complete the site excavation in full compliance with all applicable standards, codes, laws, ordinances, regulations and/or requirements of any applicable State, Federal or governmental agency.

§ 16.9 DISCRIMINATION

§ 16.9.1 Each Contract entered into by a governmental agency for the construction, alteration or repair of any public building or public work shall contain the following provisions by which the Contractor agrees:

.1 In the hiring of any employees for the manufacturer of supplies, performance of the Work, or any other activity required under the Contract or any subcontract, the Contractor, Subcontractor, or any person acting on behalf of the Contractor or Subcontractor shall not, by reason of gender, race, creed, or color, discriminate against any citizen of the Commonwealth of Pennsylvania who is qualified and available to perform the Work to which the employment relates. (62 Pa. C.S.A. Section 3701).

.2 Neither the Contractor nor any Subcontractor nor any person on their behalf shall in any manner discriminate against or intimidate any employee involved in the manufacturer of supplies, the performance of Work, or any other activity required under the Contract on account of gender, race, creed, or color. (62 Pa. C.S.A. Section 3701).

.3 Contractors and Subcontractors shall establish and maintain a written sexual harassment policy and shall inform their employees of the policy. The policy must contain a notice that sexual harassment will not be tolerated and employees who practice it will be disciplined.

.4 Contractors shall not discriminate by reason of gender, race, creed, or color against any Subcontractor or supplier who is qualified to perform the Work to which the Contracts relates.

.5 Contractors and each Subcontractor shall furnish necessary employment documents and records to and permit access to their books, records, and accounts by the contracting agency and the Bureau of Contract Administration and Business Development, for purposes of investigation, to ascertain compliance with provisions of this Paragraph. If the Contractor or any Subcontractor does not possess documents or records reflecting the necessary information requested, the Contractor or Subcontractor shall furnish such information on reporting forms supplied by the contracting agency or the Bureau of Contract Administration and Business Development.

.6 The Contractor shall include, without limitation, the provisions of this Paragraph in every subcontract so that such provisions will be binding, upon each Subcontractor.

.7 The Commonwealth of Pennsylvania may cancel or terminate the Contract and all money due or to become due under the Contract may be forfeited for a violation of the terms and conditions of this Paragraph. In addition, the agency may proceed with debarment or suspension and may place the Contractor in the contractor responsibility file.

§ 16.10 PENNSYLVANIA UNIFORM CONSTRUCTION CODE

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

§ 16.11 RIGHT-TO-KNOW LAW

§ 16.11.1 Contractors shall comply with all requirements of Pennsylvania's Right-To-Know Law, 65 P.S. § 67.101, et seq., and as amended from time to time. Contractors shall provide all information regarding the composition of all materials and products used or installed as part of this Work when required.

§ 16.12 CONTRACTOR RESPONSIBILITY PROVISIONS

§ 16.12.1 The Contractor certifies, for itself and all its Subcontractors, that as of the date of its execution of this Bid/Contract, that neither the Contractor, nor any Subcontractors, nor any suppliers are under suspension or debarment by the Commonwealth of Pennsylvania or any governmental entity, instrumentality, or authority and, if the Contractor cannot so certify, then it agrees to submit, along with its Bid, a written explanation of why such certification cannot be made.

§ 16.12.2 The Contractor also certifies, that as of the date of its execution of its Bid and the Contract, it has no tax liabilities or Commonwealth of Pennsylvania obligations.

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§ 16.12.3 The Contractor's obligations pursuant to these provisions are ongoing from and after the effective date of the Contract through the termination date thereof. Accordingly, the Contractor shall have an obligation to inform the Owner if, at any time during the term of the Contract, it becomes delinquent in the payment of taxes, or other Commonwealth of Pennsylvania obligations, or if it or any of its Subcontractors are suspended or debarred by the Commonwealth of Pennsylvania, the federal government, or any other state or governmental entity. Such notification shall be made within fifteen (15) days of the date of suspension or debarment.

§ 16.12.4 The failure of the Contractor to notify the Owner of its suspension or debarment by the Commonwealth of Pennsylvania, any other state, or the federal government shall constitute an event of default of the Contract with the Owner.

§ 16.12.5 The Contractor agrees to reimburse the Owner for the reasonable costs of investigation incurred by the Owner for investigations of the Contractor's compliance with the terms of this or any other agreement between the Contractor and the Owner. Such costs shall include, but shall not be limited to, salaries of investigators, including, without limitation, overtime, travel and lodging expenses, legal fees, professional fees, architect fees, construction management fees, expert witness fees, documentary fees and all other costs and expenses related thereto.

§ 16.12.6 The Contractor may obtain a current list of suspended and debarred Commonwealth of Pennsylvania Contractors by either searching the internet at http://www.dgs.state.pa.us/ or contacting the:

Department of General Services
Office of Chief Counsel
603 North Office Building
Harrisburg, PA 17125
Telephone No.: 717-787-6472
FAX No.: 717-787-9138

§ 16.12.7 The Contractor shall execute a Waiver of Liens in the form included in the Contract Documents.

§ 16.12.8 The Contractor hereby waives any rights that the Contractor has or may have under the Pennsylvania Prompt Pay Act, 62 Pa.C.S.A. § 3931, et seq. as amended from time to time.

§ 16.12.9 The Contractor hereby agrees to comply with all applicable Federal and State laws, including, without limitation, all laws, ordinances, rules and regulations of any authorities having jurisdiction over the Project which apply to Asbestos, including, without limitation, any such laws, ordinances, rules and regulations set forth in the General Requirements. Furthermore, such laws, ordinances, rules and regulations are deemed to be included in the Contract Documents the same as though herein written in full.

§ 16.12.10 To ensure compliance with all applicable Pennsylvania state labor and workforce safety laws, the Bid shall be accompanied by a completed Worker Protection and Investment Certification Form BOP-2201 acknowledging the Bidder's responsibilities and compliance with Executive Order 2021-06, Worker Protection and investment, October 21, 2021. Refer to Section 22 for the Worker Protection and Investment Certification Form BOP-2201. The Worker Protection and Investment Certification Form BOP-2201 shall be executed by a representative who has sufficient knowledge and authority to make the representations and certifications contained in the Form.

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AIA® Document A101™ – 2007

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a Stipulated Sum

COUNTY AGREEMENT #

AGREEMENT made as of the «_____» day of «_____» in the year 2026

BETWEEN the Owner:

County of Berks
Berks County Services Center
633 Court Street
Reading, PA 19601

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:

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.

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

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is odified.

Any reference to Architect in this documents refers to Engineer/Architect.

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

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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, all of which 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 a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement 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.)

«»

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

« »

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than « » (« ») days from the date of commencement, or as follows:

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« »

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.

««»

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be «» ($ «»), 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 the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 4.3 Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit ($0.00)
« »		

§ 4.4 Allowances
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price
« »	

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the 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.

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

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the ten (10) days prior to the last day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the last day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than sixty (60) days after the Architect receives the Application for Payment.

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the

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Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

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

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

.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 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 shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.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%);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and

.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 AIA Document A201–2007.

§ 5.1.8 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 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

« »

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

.3 **the Contractor has completed all work in compliance with all applicable codes, laws, ordinances and regulations which affect the Project and the Work has passed all inspections.**

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

«»

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§ 5.2.3 Final Payment of any amount so withheld for the completion of minor items shall be paid within thirty (30) days after written notice by the Contractor or thirty (30) days after written verification of completion of said items by the Architect, whichever is later.

§ 5.2.4 If Final Payment due the Contractor from the Owner is not paid within the time period set forth in Section 6.1 of this Agreement except for amounts disputed in good faith by the Owner and as otherwise set forth in the Contract Documents, then the Contractor shall be entitled to interest at the rate of two percent (2%) per annum.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »
« »
« »

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[X] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 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.

two percent (2%) per annum

§ 8.3 The Owner's representative:

Josh Williams, Facilities and Operations
Berks County Services Center
633 Court Street, 16th Floor
Reading, PA 19601
Telephone Number: 610-478-6201 ext. 6209
Email Address: Jwilliams@berkspa.gov

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User Notes: (3B9ADA41)

§ 8.4 The Contractor's representative:
(Name, address and other information)

« »
« »
« »
« »
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« »

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten (10) days written notice to the other party.

§ 8.6 Other provisions:
In the event of conflicts, inconsistencies or discrepancies between and/or within the Contract Documents and/or applicable standards, codes, laws, ordinances, regulations and/or requirements of any state, federal or any other governmental agency, the Contractor shall (1) provide the better quality and greater quantity of Work; or (2) comply with the more stringent requirement, or both, in accordance with the Owner's interpretation.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
« »			

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages
« »			

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Number	Title	Date
« »		

§ 9.1.6 The Addenda, if any:

Number	Date	Pages
« »		

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 Additional documents, if any, forming part of the Contract Documents:

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User Notes: (3B9ADA41)

AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

« »

.1 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides 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.)

« »

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.

Type of insurance or bond	Limit of liability or bond amount ($0.00)
« »	

This Agreement entered into as of the day and year first written above.

County of Berks	« »
OWNER*(Signature)*	***CONTRACTOR****(Signature)*
	« »«»
	(Printed name and title)
ATTEST:	**ATTEST:**
	(Signature)
	(Printed name and title)

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User Notes: (3B9ADA41)

WORKER PROTECTION AND INVESTMENT CERTIFICATION FORM

A. Pursuant to Executive Order 2021-06, *Worker Protection and Investment* (October 21, 2021), the Commonwealth is responsible for ensuring that every worker in Pennsylvania has a safe and healthy work environment and the protections afforded them through labor laws. To that end, contractors and grantees of the Commonwealth must certify that they are in compliance with Pennsylvania's Unemployment Compensation Law, Workers' Compensation Law, and all applicable Pennsylvania state labor and workforce safety laws including, but not limited to:

1. Construction Workplace Misclassification Act
2. Employment of Minors Child Labor Act
3. Minimum Wage Act
4. Prevailing Wage Act
5. Equal Pay Law
6. Employer to Pay Employment Medical Examination Fee Act
7. Seasonal Farm Labor Act
8. Wage Payment and Collection Law
9. Industrial Homework Law
10. Construction Industry Employee Verification Act
11. Act 102: Prohibition on Excessive Overtime in Healthcare
12. Apprenticeship and Training Act
13. Inspection of Employment Records Law

B. Pennsylvania law establishes penalties for providing false certifications, including contract termination; and three-year ineligibility to bid on contracts under 62 Pa. C.S. § 531 (Debarment or suspension).

CERTIFICATION

I, the official named below, certify I am duly authorized to execute this certification on behalf of the contractor/grantee identified below, and certify that the contractor/grantee identified below is compliant with applicable Pennsylvania state labor and workplace safety laws, including, but not limited to, those listed in Paragraph A, above. I understand that I must report any change in the contractor/grantee's compliance status to the Purchasing Agency immediately. I further confirm and understand that this Certification is subject to the provisions and penalties of 18 Pa. C.S. § 4904 (Unsworn falsification to authorities).

Signature ***Date***
Name (Printed)
Title of Certifying Official (Printed)
Contractor/Grantee Name (Printed)

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project Name:	Renovations and Addition to the Keystone Regional Youth Center
General Description:	The Project consists of the renovation of approximately 57,400 SF of an existing youth detention facility (30,200 SF footprint) and the construction of an approximately 1600 SF addition. The Work shall include, but is not necessarily limited to, furnishing all labor, superintendence, materials, tools, and equipment, and performing all work necessary to complete all Construction and systems.
Project Locality	Bern Township
Awarding Agency:	County of Berks
Contract Award Date:	12/3/2026
Serial Number:	26-08683
Project Classification:	Building
Determination Date:	9/28/2026
Assigned Field Office:	Scranton
Field Office Phone Number:	(570)963-4577
Toll Free Phone Number:	(877)214-3962
Project County:	Berks County

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-08683 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Asbestos & Insulation Workers	6/30/2025		$41.50	$29.86	$71.36
Asbestos & Insulation Workers	6/29/2026		$43.50	$31.11	$74.61
Boilermaker (Commercial, Institutional, and Minor Repair Work)	3/1/2026		$41.34	$19.23	$60.57
Boilermakers	1/1/2026		$58.00	$36.57	$94.57
Bricklayers, Stone Masons, Pointers, Caulkers, Cleaners	5/3/2026		$43.53	$19.17	$62.70
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2026		$36.84	$22.69	$59.53
Carpenters, Drywall Hangers, Framers, Instrument Men, Lathers, Soft Floor Layers	6/1/2027		$36.84	$24.94	$61.78
Cement Finishers & Plasterers	5/3/2026		$34.23	$22.27	$56.50
Cement Finishers & Plasterers	5/3/2027		$33.49	$25.01	$58.50
Cement Masons	5/1/2025		$35.85	$20.90	$56.75
Dockbuilder, Pile Drivers	5/1/2026		$56.98	$37.99	$94.97
Dockbuilder/Pile Driver Diver	5/1/2026		$66.54	$41.74	$108.28
Dockbuilder/pile driver tender	5/1/2026		$56.98	$37.99	$94.97
Drywall Finisher	5/1/2026		$33.02	$24.00	$57.02
Electricians	9/1/2025		$46.02	$28.39	$74.41
Electricians	8/31/2026		$48.02	$29.46	$77.48
Elevator Constructor	1/1/2026		$64.06	$46.01	$110.07
Floor Coverer	5/1/2025		$37.78	$19.80	$57.58
Floor Coverer	5/1/2026		$38.59	$20.61	$59.20
Glazier	5/1/2024		$39.48	$23.81	$63.29
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2026		$40.51	$33.88	$74.39
Laborers (Class 01 - See notes)	5/1/2025		$29.27	$17.84	$47.11
Laborers (Class 01 - See notes)	5/1/2026		$30.12	$18.49	$48.61
Laborers (Class 02 - See notes)	5/1/2026		$32.12	$18.49	$50.61
Laborers (Class 02 - see notes)	5/1/2025		$31.27	$17.84	$49.11
Laborers (Class 03 - See notes)	4/27/2025		$31.82	$18.09	$49.91
Laborers (Class 03 - See notes)	5/1/2026		$32.82	$18.74	$51.56
Laborers (Class 04 - See notes)	4/27/2025		$33.82	$18.09	$51.91
Laborers (Class 04 - See notes)	5/1/2026		$34.32	$18.74	$53.06
Laborers (Class 05 - See notes)	5/1/2025		$31.27	$17.84	$49.11
Laborers (Class 05 - See notes)	5/1/2026		$32.12	$18.49	$50.61
Laborers (Class 06 - See notes)	5/1/2025		$30.62	$17.84	$48.46
Laborers (Class 06 - See notes)	5/1/2026		$31.47	$18.49	$49.96
Marble Mason	5/1/2025		$37.71	$18.73	$56.44
Marble Mason	5/3/2026		$37.72	$20.67	$58.39
Millwright	6/1/2025		$43.00	$22.95	$65.95
Millwright	6/1/2026		$44.97	$22.95	$67.92
Operators (Building, Class 01 - See Notes)	5/1/2025		$44.89	$30.92	$75.81
Operators (Building, Class 01 - See Notes)	5/1/2026		$46.05	$31.76	$77.81
Operators (Building, Class 01A - See Notes)	5/1/2025		$47.14	$31.58	$78.72
Operators (Building, Class 01A - See Notes)	5/1/2026		$48.30	$32.42	$80.72

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-08683 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Building, Class 02 - See Notes)	5/1/2025		$44.61	$30.83	$75.44
Operators (Building, Class 02 - See Notes)	5/1/2026		$45.77	$31.67	$77.44
Operators (Building, Class 02A - See Notes)	5/1/2025		$46.86	$31.50	$78.36
Operators (Building, Class 02A - See Notes)	5/1/2026		$48.02	$32.34	$80.36
Operators (Building, Class 03 - See Notes)	5/1/2025		$41.88	$30.03	$71.91
Operators (Building, Class 03 - See Notes)	5/1/2026		$43.04	$30.87	$73.91
Operators (Building, Class 04 - See Notes)	5/1/2025		$40.74	$29.70	$70.44
Operators (Building, Class 04 - See Notes)	5/1/2026		$41.90	$30.54	$72.44
Operators (Building, Class 05 - See Notes)	5/1/2025		$40.30	$29.56	$69.86
Operators (Building, Class 05 - See Notes)	5/1/2026		$41.45	$30.41	$71.86
Operators (Building, Class 06 - See Notes)	5/1/2025		$39.42	$29.30	$68.72
Operators (Building, Class 06 - See Notes)	5/1/2026		$40.58	$30.14	$70.72
Operators (Building, Class 07A- See Notes)	5/1/2025		$54.56	$35.21	$89.77
Operators (Building, Class 07A- See Notes)	5/1/2026		$56.03	$36.14	$92.17
Operators (Building, Class 07B- See Notes)	5/1/2025		$54.22	$35.10	$89.32
Operators (Building, Class 07B- See Notes)	5/1/2026		$55.69	$36.03	$91.72
Painters Class 1 (see notes)	5/1/2025		$32.71	$24.17	$56.88
Painters Class 1 (see notes)	5/1/2026		$33.89	$24.69	$58.58
Painters - Line Stripping	12/1/2024		$44.12	$27.91	$72.03
Painters - Line Stripping	12/1/2025		$45.12	$29.41	$74.53
Painters Class 2 (see notes)	5/1/2023		$30.09	$23.19	$53.28
Painters Class 2 (see notes)	5/1/2025		$35.61	$24.18	$59.79
Painters Class 3 (see notes)	5/1/2025		$41.71	$24.18	$65.89
Piledrivers	5/1/2021		$43.73	$37.99	$81.72
Plasterers	5/1/2024		$32.93	$21.08	$54.01
Plasterers	5/1/2025		$34.68	$21.23	$55.91
plumber	5/1/2025		$56.28	$36.01	$92.29
plumber	5/1/2026		$58.43	$36.61	$95.04
Roofers (Composition)	5/1/2025		$46.03	$34.77	$80.80
Roofers (Composition)	5/1/2026		$47.53	$35.22	$82.75
Roofers (Shingle)	5/1/2024		$34.35	$22.20	$56.55
Roofers (Slate & Tile)	5/1/2024		$37.35	$22.20	$59.55
Sheet Metal Workers	6/1/2025		$45.02	$44.71	$89.73
Sheet Metal Workers	6/1/2026		$46.62	$46.36	$92.98
Sign Makers and Hangars	7/15/2025		$33.48	$26.41	$59.89
Sign Makers and Hangars	7/15/2026		$36.38	$25.01	$61.39
Sprinklerfitters	4/1/2025		$49.75	$29.21	$78.96
Sprinklerfitters	4/1/2026		$52.82	$30.56	$83.38
Steamfitters	5/1/2024		$59.65	$43.09	$102.74
Steamfitters	5/1/2025		$61.47	$44.89	$106.36
Terrazzo Finisher	5/1/2025		$36.32	$21.68	$58.00
Terrazzo Finisher	5/1/2026		$37.12	$22.76	$59.88
Terrazzo Grinder	5/1/2025		$37.10	$21.68	$58.78
Terrazzo Grinder	5/1/2026		$37.93	$22.76	$60.69

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-08683 - Building	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Terrazzo Mechanics	5/1/2025		$37.17	$23.43	$60.60
Terrazzo Mechanics	5/1/2026		$38.06	$24.51	$62.57
Tile & Marble Finisher	5/1/2025		$35.31	$16.99	$52.30
Tile & Marble Finisher	5/1/2026		$37.26	$16.99	$54.25
Tile Setter	5/1/2025		$37.71	$18.73	$56.44
Tile Setter	5/3/2026		$37.72	$20.67	$58.39
Truckdriver class 1(see notes)	5/1/2025		$41.87	$0.00	$41.87
Truckdriver class 2 (see notes)	5/1/2025		$41.94	$0.00	$41.94
Truckdriver class 3 (see notes)	5/1/2025		$42.43	$0.00	$42.43
Window Film / Tint Installer	6/1/2025		$27.42	$15.13	$42.55
Window Film / Tint Installer	6/1/2026		$28.35	$15.60	$43.95

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-08683 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Carpenter	5/1/2026		$37.63	$21.18	$58.81
Carpenter Welder	5/1/2026		$38.38	$21.18	$59.56
Carpenters - Piledriver/Welder	1/1/2026		$38.38	$21.18	$59.56
Cement Finishers	1/1/2017		$27.70	$20.20	$47.90
Dockbuilder, Pile Drivers	5/1/2026		$56.98	$37.99	$94.97
Dockbuilder/Pile Driver Diver	5/1/2026		$61.88	$45.47	$107.35
Dockbuilder/pile driver tender	5/1/2026		$56.98	$37.99	$94.97
Electric Lineman	6/3/2024		$52.80	$30.61	$83.41
Electric Lineman	6/2/2025		$55.42	$31.04	$86.46
Iron Workers (Bridge, Structural Steel, Ornamental, Precast, Reinforcing)	7/1/2024		$37.26	$32.63	$69.89
Laborers (Class 01 - See notes)	5/1/2025		$26.61	$19.99	$46.60
Laborers (Class 01 - See notes)	5/1/2026		$27.61	$20.44	$48.05
Laborers (Class 02 - See notes)	5/1/2025		$33.23	$19.99	$53.22
Laborers (Class 02 - See notes)	5/1/2026		$34.23	$20.44	$54.67
Laborers (Class 03 - See notes)	5/1/2025		$30.22	$19.99	$50.21
Laborers (Class 03 - See notes)	5/1/2026		$31.22	$20.44	$51.66
Laborers (Class 04 - See notes)	5/1/2025		$30.57	$19.99	$50.56
Laborers (Class 04 - See notes)	5/1/2026		$31.57	$20.44	$52.01
Laborers (Class 05 - See notes)	5/1/2025		$31.24	$19.99	$51.23
Laborers (Class 05 - See notes)	5/1/2026		$32.24	$20.44	$52.68
Laborers (Class 06 - See notes)	5/1/2025		$30.66	$19.99	$50.65
Laborers (Class 06 - See notes)	5/1/2026		$31.66	$20.44	$52.10
Laborers (Class 07 - See notes)	5/1/2025		$30.95	$19.99	$50.94
Laborers (Class 07 - See notes)	5/1/2026		$31.95	$20.44	$52.39
Laborers (Class 08 - See notes)	5/1/2025		$31.43	$19.99	$51.42
Laborers (Class 08 - See notes)	5/1/2026		$32.43	$20.44	$52.87
Millwright	6/1/2026		$47.52	$23.33	$70.85
Operators (Heavy, Class 01 - See Notes)	5/1/2025		$43.46	$30.50	$73.96
Operators (Heavy, Class 01 - See Notes)	5/1/2026		$44.61	$31.35	$75.96
Operators (Heavy, Class 01A - See Notes)	5/1/2025		$45.71	$31.16	$76.87
Operators (Heavy, Class 01A - See Notes)	5/1/2026		$46.86	$32.01	$78.87
Operators (Heavy, Class 02 - See Notes)	5/1/2025		$43.18	$30.41	$73.59
Operators (Heavy, Class 02 - See Notes)	5/1/2026		$44.34	$31.25	$75.59
Operators (Heavy, Class 02A - See Notes)	5/1/2025		$45.43	$31.08	$76.51
Operators (Heavy, Class 02A - See Notes)	5/1/2026		$46.59	$31.92	$78.51
Operators (Heavy, Class 03 - See Notes)	5/1/2025		$40.26	$29.55	$69.81
Operators (Heavy, Class 03 - See Notes)	5/1/2026		$41.43	$30.38	$71.81
Operators (Heavy, Class 04 - See Notes)	5/1/2025		$39.12	$29.22	$68.34
Operators (Heavy, Class 04 - See Notes)	5/1/2026		$40.28	$30.06	$70.34
Operators (Heavy, Class 05 - See Notes)	5/1/2025		$38.67	$29.09	$67.76
Operators (Heavy, Class 05 - See Notes)	5/1/2026		$39.83	$29.93	$69.76
Operators (Heavy, Class 06 - See Notes)	5/1/2025		$37.80	$28.82	$66.62
Operators (Heavy, Class 06 - See Notes)	5/1/2026		$38.96	$29.66	$68.62
Operators (Heavy, Class 07A - See Notes)	5/1/2025		$52.85	$34.71	$87.56

BUREAU OF LABOR LAW COMPLIANCE
PREVAILING WAGES PROJECT RATES

Project: 26-08683 - Heavy/Highway	Effective Date	Expiration Date	Hourly Rate	Fringe Benefits	Total
Operators (Heavy, Class 07A - See Notes)	5/1/2026		$54.32	$35.64	$89.96
Operators (Heavy, Class 07B - See Notes)	5/1/2025		$52.51	$34.60	$87.11
Operators (Heavy, Class 07B - See Notes)	5/1/2026		$53.97	$35.54	$89.51
Operators (Highway, Class 01 - See Notes)	5/1/2025		$42.56	$30.24	$72.80
Operators (Highway, Class 01 - See Notes)	5/1/2026		$43.72	$31.08	$74.80
Operators (Highway, Class 01a - See Notes)	5/1/2025		$44.81	$30.92	$75.73
Operators (Highway, Class 01a - See Notes)	5/1/2026		$45.97	$31.76	$77.73
Operators (Highway, Class 02 - See Notes)	5/1/2025		$41.39	$29.89	$71.28
Operators (Highway, Class 02 - See Notes)	5/1/2026		$42.55	$30.73	$73.28
Operators (Highway, Class 03 - See Notes)	5/1/2025		$40.70	$29.68	$70.38
Operators (Highway, Class 03 - See Notes)	5/1/2026		$41.87	$30.51	$72.38
Operators (Highway, Class 04 - See Notes)	5/1/2025		$40.26	$29.54	$69.80
Operators (Highway, Class 04 - See Notes)	5/1/2026		$41.41	$30.39	$71.80
Operators (Highway, Class 05 - See Notes)	5/1/2025		$39.73	$29.41	$69.14
Operators (Highway, Class 05 - See Notes)	5/1/2026		$40.89	$30.25	$71.14
Operators (Highway, Class 06 - See Notes)	5/1/2025		$42.80	$30.30	$73.10
Operators (Highway, Class 06 - See Notes)	5/1/2026		$43.95	$31.15	$75.10
Operators (Highway, Class 06/A - See Notes)	5/1/2025		$45.05	$30.96	$76.01
Operators (Highway, Class 06/A - See Notes)	5/1/2026		$46.21	$31.80	$78.01
Operators (Highway, Class 07/A - See Notes)	5/1/2025		$51.79	$34.38	$86.17
Operators (Highway, Class 07/A - See Notes)	5/1/2026		$53.25	$35.32	$88.57
Operators (Highway, Class 07/B - See Notes)	5/1/2025		$50.37	$33.97	$84.34
Operators (Highway, Class 07/B - See Notes)	5/1/2026		$51.84	$34.90	$86.74
Painters - Line Stripping	12/1/2024		$44.12	$27.91	$72.03
Painters - Line Stripping	12/1/2025		$45.12	$29.41	$74.53
Painters Class 2 (see notes)	5/1/2025		$35.61	$24.18	$59.79
Painters Class 2 (see notes)	5/1/2026		$38.00	$24.79	$62.79
Painters Class 3 (see notes)	5/1/2025		$41.71	$24.18	$65.89
Painters Class 3 (see notes)	5/1/2026		$44.10	$24.79	$68.89
Piledrivers	5/1/2025		$36.87	$20.49	$57.36
Piledrivers	5/1/2026		$37.63	$21.18	$58.81
Steamfitters (Heavy and Highway - Gas Distribution)	5/1/2025		$54.39	$44.73	$99.12
Truckdriver class 1(see notes)	5/1/2025		$41.87	$0.00	$41.87
Truckdriver class 2 (see notes)	5/1/2025		$41.94	$0.00	$41.94
Truckdriver class 3 (see notes)	5/1/2025		$42.43	$0.00	$42.43

SECTION 01 11 01 - SUMMARY OF WORK - MULTIPLE PRIME CONTRACTS

PART 1 GENERAL

1.1 GENERAL DESCRIPTION OF THE SCOPE OF WORK

A. The Project consists of the renovation of approximately 57,400 SF of an existing youth detention facility (30,200 SF footprint) and the construction of an approximately 1600 SF addition.

B. The Work shall include, but is not necessarily limited to, furnishing all labor, superintendence, materials, tools, and equipment, and performing all work necessary to complete all Construction and systems to the satisfaction of, and approval by the Owner.

C. It is not the intent to delineate or describe every detail and feature of the Work in this Section or within the Contract Documents. Therefore, the Contractor shall include and perform all work necessary to provide a completed project; whether related to portions of the project, or the project in its entirety. This includes providing all labor, materials and equipment, selective demolition, and any cutting and patching as may be required to accomplish the intended construction and installations.

D. Each Contractor shall staff the project adequately to maintain the project schedule and to support the work of other contractors. Each Contractor shall employ his workers for overtime work without additional cost to the Owner if required to meet completion dates.

E. Work for the Project shall be accomplished by Separate Prime Contractors according to Pennsylvania statute. Prime Contracts are separate contracts that represent significant construction activities performed concurrently with and closely coordinated with construction activities performed on the Project under other Prime Contracts.

F. The Owner has employed the firm of Dolan Construction to serve as Construction Manager for the project.

G. All submittals, construction RFI's, change orders, etc. shall be submitted via the Construction software Procore. There is no charge to the contractor for this software.

H. Prime Contracts for this Project include:
1. General Construction Contract.
2. Plumbing Contract.
3. H.V.A.C. Contract.
4. Electrical Contract.

I. The General Contractor shall be the Lead Prime Contractor. Specific instructions for coordination and responsibilities of the Lead Prime Contractor are contained in Division 01, Section 01 31 13 "Project Coordination", and elsewhere throughout the Contract Documents.

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J. ALL Prime Contractors shall be responsible for requirements contained in the Division 01 Specifications, except where responsibility is specifically assigned to another Prime Contractor.

K. For this project, the low voltage, access control, surveillance and security work, including the access control door hardware (Salto System) is included in the Electrical Contract, but portions of the work as further defined below shall be performed by the preferred vendor of the Owner, TWG. Each bidder shall be provided with a set price for the work from this vendor to be included in their bid. No exceptions will be allowed.

L. For this project, the mechanical controls work, and the fire alarm work are included in the Mechanical and Electrical Contracts as is typical, but portions of the work as further defined below shall be performed by the preferred vendor of the Owner, NRG. Each Mechanical and Electrical bidder shall be provided with a set price divided by prime contract for the work from this vendor to be included in their bid. No exceptions will be allowed.

M. For this project, the detention and non-detention door hardware is included in the General Contract as is typical. However, the access control non-detention grade locks, handles and latches (Salto System) will be supplied by TWG through the Electrical Contract. All other door hardware for detention and non-detention doors will be by the General Contractor, including auxiliary hardware on doors receiving the Salto locks. Door hardware in the General Contract will be supplied by the preferred vendor of the Owner, HC Quality Doors with the exception of the detention grade locksets (Folger Adams BOD). Each General Contract bidder shall be provided with a set price for the hardware supplied from this vendor to be included in their bid. No exceptions will be allowed. Hardware supplied by HC Quality Doors shall be installed by the General Contractor.

N. Prime Contract Work: The following summaries and lists of work are provided for the convenience of the Contractors and to assist with clarifying the Prime Contract scopes of work. They are not intended or considered to be all inclusive or a finite representation of any Contractor's scope of work. Each prime Contract can be generally summarized as follows:

1. <u>General Construction Contract:</u>

Work in the General Construction Contract includes, but is not necessarily limited to architectural, structural, and civil construction within and on the buildings and sites, plus other activities traditionally recognized as general construction. It also includes project administrative and coordination responsibilities described throughout the Division 01 Specification Sections. The Work under this prime Contract generally includes but is not limited to:

a. Principal responsibilities as Lead Prime Contractor and project coordinator affecting coordination of all trades.
b. Architectural, Civil, Structural Drawings, and Division 01 thru Division 13, 31 & 32 of the Specifications. This does not preclude the General Contractor from being aware of the contents of all documents, and any associated responsibilities for the General Construction Contract contained therein.
c. Coordination of work with all other trades.

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d. Cutting and Patching of finishes to remain for all trades. This does not include selective demolition related to a specific trade, but rather the cutting of finishes to remain, which the General Contractor will be responsible for patching and finishing. The General Contractor shall perform the cutting and patching prior to and in coordination with the demolition work performed by other trades.
e. Temporary Facilities as specified in the temporary facilities section.
f. Asphaltic Paving, Sealing & Striping
g. Concrete paving including sidewalks and ramps.
h. Erosion control.
i. Earthwork.
j. Site clearing and demolition.
k. Building layout.
l. Building excavation and backfill.
m. Stormwater piping to existing stormwater management facilities, or to surface discharge, as described in the documents, to 5'0" outside of the building for new piping, or to point of connection for existing piping. Connection of new piping at the building shall be by the Plumbing Contractor. Connection to existing piping shall be by the General Contractor.
n. Any required Site Sanitary Sewer Work beyond 5' outside of building. The Plumbing Contractor will make connections, repairs or replacements at the building line (5' out).
o. Interior and Exterior Fencing and Guardrails including any removal, reinstallation, replacement or addition of fencing and gates, and gate hardware.
p. Security Sealant at all required locations. This will require sealing at work installed by other Prime Contractors.
q. Sealants required to complete the General Contractor's scope of work.
r. Any cosmetic sealing prior to finishes being applied or to complete finish installations.
s. Each Prime Contractor is responsible for weatherproofing and firestopping their installations.
t. Casework and Millwork
u. Canopies and Walkways.
v. Footings and foundations.
w. Concrete and concrete unit masonry construction.
x. Exterior Equipment Pads
y. Structural steel and all miscellaneous metal/steel work, construction of stairs, rails, lintels, angles, etc.
z. Any other structural work contained in the structural drawings and specifications.
aa. Cold Formed metal framing.
bb. Wood Framing and Blocking.
cc. Thermal and moisture protection systems.
dd. Roofing
ee. Gutters, Leaders and boots.
ff. Doors and windows.

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gg. Coordination of door preparation for all door hardware and access control systems, whether supplied by the General Contract or other contracts. Refer to attached TWG Scope of Work.
hh. Door hardware (Detention & Non-Detention), as described previously in this section. Refer to TWG Scope of Work and HC Quality Door information attached to this section.
ii. Exterior and interior finishes. (Including cutting and patching of all finishes as required by the work of any/all trades).
jj. Exterior and Interior Signage
kk. Gypsum Board Systems.
ll. Building Specialties.
mm. Ceilings
nn. Equipment and accessories, including installation, start up and commissioning.
oo. Kitchen Equipment and Accessories, including the Ansul System. Final connections by the Applicable Trade Contractor.
pp. Final cleaning.
qq. Kitchen Equipment and Kitchen Cleaning.
rr. All handrails and guardrails.
ss. Progress photographs, development of the overall project schedule, and maintenance and updating of the overall project schedule.
tt. Field engineering and site survey, including establishment of reference points for all trades.

2. The Plumbing Contract:

The Work of the Plumbing Contract includes all plumbing and fire protection systems, including all related equipment, fixtures, and accessories to provide complete and operating systems within, and on the building. The Plumbing Contract includes all work typical to the plumbing and fire protection trades. It also includes project administrative and coordination responsibilities described throughout the Division 01 Specification Sections. Work under this Prime Contract includes but is not limited to:

a. The contents of the Plumbing and Fire Protection Drawings and Divisions 01, 11, 21 and 22 of the Specifications. This does not preclude the Plumbing Contractor from being aware of the contents of all documents, and any associated responsibilities contained therein.
b. Selective demolition, cutting and patching for plumbing work. Coordinate with the General Contractor prior to any demolition. The General Contractor shall perform cutting and patching of finishes to remain prior to selective demolition by this trade. The Plumbing Contractor shall coordinate with the General Contactor for final finishing work.
c. Coordination of Work with all other trades.
d. Water storage and distribution systems throughout the building, and on the building exterior from the point exiting the building to a point five feet perpendicular from the point of exit. Make all connections.
e. Storm drainage, sanitary sewer, and vent systems throughout the building, and on the building exterior from the point exiting the building to a point five feet

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perpendicular from the point of exit. Provide connections of new piping to exterior.

f. Plumbing fixtures and equipment, including detention fixtures.
g. All Fire Protection systems and equipment.
h. Temporary plumbing facilities and individual contractor facilities specified in the Division 01 "Temporary Facilities" Specification Section.
i. Plumbing Rough-in and final connections for kitchen equipment.
j. Roof drains and interior conductors. Coordinate with General Contractor.
k. Grease Trap, piping and connections.
l. Fire Pump and Controls
m. Controls Systems related to this contract, and coordination with the Owner's preferred controls vendor for building and fire alarm controls systems related to the Plumbing Contract (See NRG scope of work for delineation).
n. Firestopping and weatherproofing/sealing for installations and work of this contract.
o. Start-Up, Testing and Commissioning related to this contract.

3. <u>Mechanical Contract:</u>

The Mechanical Contract includes the work of all mechanical and HVAC systems, equipment, controls, and components, including related work and accessories, necessary to provide complete, and fully operating systems. It also includes project administrative and coordination responsibilities described throughout the Division 01 Specification Sections. The Mechanical Contract includes all work typical to the mechanical trades including but not limited to:

a. Work identified in the mechanical drawings and Divisions 01, 11, and 23 of the specifications. This does not preclude the Mechanical Contractor from being aware of the contents of all documents, and any associated responsibilities contained therein.
b. Selective demolition, cutting and patching for mechanical work. Coordinate with the General Contractor prior to any demolition. The General Contractor shall perform cutting and patching of finishes to remain prior to selective demolition by this trade. The Mechanical Contractor shall coordinate with the General Contactor for final finishing work.
c. All gas piping, fittings, and conveyance, regulating and metering equipment within or outside the building regardless of distance from the building.
d. Hydronic and refrigerant piping and other mechanical piping.
e. Control Valves and Dampers, including the replacement of existing mechanical control valves. (Refer to NRG Scope of Work for delineation)
f. Firestopping and weatherproofing/sealing for installations and work of this contract.
g. Instrumentation
h. HVAC Duct and piping insulation systems.
i. Fans , Ventilators and Exhaust Fans.
j. Roof top units and systems.
k. Heat Pump System

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l. Cabinet unit heaters
m. Condensing Units
n. Split System Units and Systems
o. Ductwork and accessories.
p. Grilles, Registers and Diffusers including security grilles, registers, diffusers.
q. Control Systems. Mechanical Controls will be by the Owners preferred vendor NRG as described previously in this section. Refer to attached NRG Scope of Work.
r. Starting/commissioning of mechanical systems and equipment.
s. Testing, adjusting and balancing of mechanical systems and equipment, including rebalancing of existing ductwork.
t. Mechanical rough-in and final connection for kitchen equipment.
u. Coordination with all other Prime Contractors

4. Electrical Contract:

5. The Electrical Contract includes electric power distribution, lighting, communication and security systems for complete and operating systems within, and on the buildings. It also includes project administrative and coordination responsibilities described throughout the Division 01 Specification Sections. The Electrical Contract includes all work typical to the electrical trades (All Voltages) including but not limited to:

a. Work identified in the electrical drawings and Divisions 01,11, 26 and 28 of the specifications. This does not preclude the Electrical Contractor from being aware of the contents of all documents, and any associated responsibilities contained therein.
b. Selective demolition, cutting and patching for mechanical work. Coordinate with the General Contractor prior to any demolition. The General Contractor shall perform cutting and patching of finishes to remain prior to selective demolition by this trade. The Electrical Contractor shall coordinate with the General Contactor for final finishing work.
c. Exterior conduit and cable related to new generators, transfer switches and connections to the existing transformer, distribution panel and to building components and equipment. The work includes required excavation.
d. Firestopping and weatherproofing/sealing for installations and work of this contract.
e. Power distribution systems and all components thereof.
f. Interior and exterior lighting systems including fixtures, power and control.
g. Electrical grounding.
h. Raceways, cable tray, power wiring, cables, boxes, and devices and equipment for all voltage levels.
i. Electronic Security Systems, Access Control Systems, Low Voltage Systems. Portions of the Work provided by TWG as described below and earlier in this section. Refer to attached TWG Scope of Work.
j. Raceways and boxes for telephone/AV/Data Systems. Connections and equipment to be provided by the Owner/TWG.

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k. Building fire alarm system and equipment. Provided by NRG as part of this contract, and as described earlier in this section. Refer to attached scope of work by NRG.
l. Arc Flash, Coordination and Short Circuit Studies.
m. Temporary facilities specified in the "Temporary Facilities" Section.
n. Coordination with all other Prime Contractors.
o. Diesel Engine Generators, Automatic Transfer Switches, Distribution Panel, and any and all conduit, cable, excavation and accessories described in the documents, and necessary to provide a fully operating emergency power system for the building.
p. Low Voltage Transformers
q. Starting/commissioning electrical systems and equipment.
r. Electrical connections to equipment furnished under other contracts, unless otherwise indicated.
s. Testing, adjusting and balancing electrical systems and equipment.
t. Electrical Rough-in and final connection for kitchen equipment.
u. Electrical connections to temporary facilities and controls furnished by the other Prime Contractors.
v. The Following portions of the Electrical Contract described previously in this section are to be provided by the Owner's preferred low voltage subcontractor TWG as part of the overall Prime Electrical Contract. Note that all raceways, conduit, cabling, boxes and related infrastructure work for low voltage systems is by the Electrical Contractor; not TWG. See attached Scope of Work by TWG

- Access control devices and equipment
- Video surveillance cameras and equipment
- Watch Tour System
- Intercom & Paging System and components
- Duress System
- Connections of low voltage equipment and devices, including Salto door hardware.
- Telecom/AV/Data devices and equipment.

O. Definition of the extent of Prime Contract Work:

The extent of each prime Contract is indicated in the Contract Documents. Except where no other more specific description is contained in the Contract Documents, general names and terminology on the Drawings and in Specification Sections determines which prime Contract includes a specific element of Work.

1. Each Prime Contractor shall provide any and all items essential, or necessary for complete and operating systems.
2. Local custom and trade-union jurisdictional settlements do not control the Scopes-of-Work included in each prime Contract. When a potential jurisdictional dispute or similar interruption of construction activities is first identified or threatened, the affected Prime Contracts shall promptly negotiate a reasonable settlement to avoid or minimize the pending interruption and its delays.

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3. Temporary office and storage facilities for each Prime Contractor are the responsibility of each Prime Contractor.

1.2 WORK UNDER OTHER CONTRACTS

A. Separate Contract(s) may be issued by the Owner to other contractor(s), or the Owner may elect to perform certain construction operations at the site with his own forces. Those operations will coordinate with and may coincide with these prime Contracts. prime Contractors shall reasonably cooperate and coordinate work with the Owner's workers or with Owner supplied contractors operating outside of the prime Contracts. Owner's workers and subcontractors will be expected to abide by established project protocol and controls while on the project site.

1.3 PRIME CONTRACTORS USE OF PREMISES

A. During the construction period the Prime Contractors jointly shall have full use of the premises for construction operations, including use of the site. The prime Contractor's use of the premises is limited only to the areas where construction operations are to occur, designated staging and storage areas and by the Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of the Project.
   1. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
   2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees at all times. Do not use these areas for parking or storage of materials.

1.4 OWNER OCCUPANCY

A. Owner Occupancy: The Owner reserves the right to occupy and to place and install equipment in completed areas of the building prior to Substantial Completion, provided that such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
   1. A Certificate of Substantial Completion will be executed for each specific portion of the Work to be occupied prior to Owner occupancy.
   2. Obtain a Certificate of Occupancy from local building officials prior to Owner occupancy.
   3. Prior to partial Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy the Owner will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

1.5 OWNER-FURNISHED ITEMS

A. The Owner may elect to furnish and/or install items or products with its own forces or with outside contractors.
   1. The Owner will arrange for delivery of Owner-furnished items an accordance with the Project Construction Schedule, and will inspect deliveries for damage.

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2. If Owner-furnished items are damaged, defective, or missing, the Owner will arrange for replacement.
3. Where Owner-furnished items are damaged as a result of a prime Contractor's operations, that prime Contractor is responsible for repairing or replacing the Owner-furnished items.

1.6 KNOWLEDGE OF CONTRACT REQUIREMENTS

A. Each Contractor and his Subcontractor's, Sub-Subcontractor's and material men shall consult in detail the General Conditions, Supplementary Conditions, all Divisions and Sections of the Specifications, all Drawings and all Addenda for instructions and requirements pertaining to the Work, and at his and their cost, shall provide all labor, materials, equipment and services necessary to furnish, install and complete the work in strict conformance with all provisions thereof.

B. Each Contractor will be held to have examined the site of the Work prior to submitting his proposal and informed himself, his Subcontractors, Sub-Subcontractors and material men of all existing conditions affecting the execution of the work.

C. Each Contractor will be held to have examined the Contract Documents, and Modifications thereto, as they may affect subdivisions of the work and informed himself, his Subcontractors, Sub-Subcontractors and material men of all conditions thereof affecting the execution of the work.

D. The Scope of Work for the Contract is not necessarily limited to the description of each section of the Specifications and the illustrations shown on the Drawings. Include all minor items not expressly indicated in the Contract Documents, or as might be found necessary as a result of field conditions, in order to complete the work as it is intended, without any gaps between the various subdivisions of work of the Contractor and his Subcontractors.

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

1.7 CONTRACT DOCUMENTS INFORMATION

A. The Contract Documents are prepared in accordance with available information as to existing conditions and locations. If, during construction, conditions are revealed at variance with the Contract Documents, notify the Construction Manager immediately so that supplementary instructions may be issued.

B. The Specifications determine the quality, kinds and methods of installation of the various materials, the Drawings establish the quantities, dimensions and details of materials, the schedules on the Drawings give the location, type and extent of the materials.

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C. Should the Drawings, Specifications or schedules disagree in themselves or with either or both of the others, the better quality or greater quantity of work or materials shall be performed and provided, unless otherwise directed in writing by the Construction Manager.

D. Dimensions given on the Drawings govern scale measurements and large scale drawings govern small scale drawings, except as to anything omitted unless such omission is expressly noted on the larger scale drawings.

E. The techniques or methods of specifying to record requirements varies throughout text, and may include "prescriptive", "open generic/descriptive", "compliance with standards", "performance", "proprietary", or a combination of these. The method used for specifying one unit of work has no bearing on requirements for another unit of work.

F. Whenever a materials, article or piece of equipment is referred to in the singular number in the Contract Documents, it shall be the same as referring to it in the plural. As many such materials, articles or pieces of equipment shall be provided as are required to complete the work.

G. With the approval of the Construction Manager and without additional cost to the Owner, the Contractor shall make all necessary changes or modifications to locations as may be necessary to suit requirements and conditions at the building and for the proper and conveniently accessible location of all parts of the system.

H. Small details not usually shown or specified, but necessary for the proper installation and operation of the work, shall be provided.

I. Cap all incomplete lines, ducts, conduits, openings, etc., until ready for final connection, after which they shall be thoroughly cleaned and left unobstructed.

PART 2 PRODUCTS (Not applicable).

PART 3 EXECUTION (Not applicable)

END OF SECTION 01 11 01

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SECTION 01 11 05 - TIME OF COMPLETION

PART 1 GENERAL

1.1 PROJECT SCHEDULE

A. Substantial Completion of the Project (issuance of Certificate of Occupancy) shall be as indicated below and shall be fully complete to the satisfaction of the Owner, Construction Manager and Architect on or before one additional month.
   1. Contractors can anticipate Notification of Intent to Award of the Contracts on or about December 3, 2026, with Notice to Proceed on January 4, 2027
   2. On site work shall commence on or about January 11, 2027
   3. Project Substantial Completion: March 31, 2028
   4. Project Final Completion: February 29, 2028

B. Liquidated damages provisions as specified in the Contract Documents shall apply to substantial completion date for the entire project.

END OF SECTION 01 11 05

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SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

1. Certain work is specified in the Contract Documents to be priced by inclusion of allowances in Prime Contractor bids. Allowances have been established because the Owner requires that certain specialized work on the project be performed by their typical subcontractors familiar with the Owner requirements and systems. Those subcontractors have provided pricing for their scopes of work which are included in Section 01 11 00 Summary of Work (scopes and pricing), and in this Section (pricing only). The stated allowances will be included on the bid form and on the successful bidders schedule of values at the stated price.

B. Types of allowances include the following:
1. Subcontractor allowances.

C. Related Sections:
1. Division 01 Section "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.
2. Division 01 Section “Summary of Work” for subcontractor scopes of work.
3. Divisions 02 through 49 Sections for items of Work covered by allowances.

1.3 SELECTION AND PURCHASE

A. Within 60 days after award of the Contract, provide an executed subcontractor agreement with each subcontractor associated with allowances to the Architect, Owner, Construction Manager for verification of compliance with the Contract Documents and for establishment of a purchase date.

B. Purchase products and systems pertaining to work included in allowances in timeframes that avoid cost escalation and that do not delay the project schedule, or the work of other contractors.

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1.4 SUBMITTALS

A. Submit subcontracts for purchase of products, work and systems included in allowances, as described in Section 1.3 .

B. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance, to verify completion of the work, and to validate the allowance price.

C. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

D. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation. Include allowance work as part of the project schedule.

1.6 SUBCONTRACTOR ALLOWANCES

A. Use of the subcontractor allowance is only as described in the Summary of Work section and the associated scopes of work.

B. Changes to allowances scope or price will only be through issuance of a change order. Any changes not requested by, or approved by, the Owner in advance may be subject to denial. Approved change orders will be reflected on the schedule of values by adjustment to the allowance.

C. Allowances will be reduced by progress of work billing by the preferred subcontractors, which are included with the prime contractor’s periodic invoices.

D. The subcontractor allowance is to be all inclusive of the subcontractor’s cost of completing the work (labor, materials, installation), and of the subcontractor’s administrative and management costs, and of their overhead and profit. Typical costs to a prime contractor of managing the subcontractor, any associated administrative costs, and mark-ups shall be included in the Prime Contractor’s General Conditions amount.

E. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

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1.7 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

B. Examine all work of subcontractors to insure compliance with the Contract Documents and the associated scope of work.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

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3.3 SCHEDULE OF ALLOWANCES

A. Allowance No EC1: The Prime Electrical Contractor to Include a Subcontractor Allowance of (to be issued via Addendum) for TWG Access Control Scope of Work as described in Section 01 11 00 Summary of Work and the Contract Documents.

B. Allowance No. EC2: The Prime Electrical Contractor to Include a Subcontractor Allowance of (to be issued via Addendum) for TWG Video Surveillance Scope of Work as described in Section 01 11 00 Summary of Work and the Contract Documents.

C. Allowance No. EC3: The Prime Electrical Contractor to Include a Subcontractor Allowance of (to be issued via Addendum) for NRG Fire Alarm Scope of Work as described in Section 01 11 00 Summary of Work and the Contract Documents.

D. Allowance No. MC1: The Prime Mechanical Contractor to Include a Subcontractor Allowance of (to be issued via Addendum) for NRG Controls and Management System Scope of Work as described in Section 01 11 00 Summary of Work and the Contract Documents.

E. Allowance No. GC1: The Prime General Contractor to Include a Subcontractor Allowance of (to be issued via Addendum) for Door Hardware (materials only. Installation by GC) Scope of Work as described in Section 01 11 00 Summary of Work and the Contract Documents

END OF SECTION 01 21 00

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SECTION 01 22 00 - UNIT PRICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 01 Section "Modification Procedures" for procedures for submitting and handling Change Orders.
   2. Division 01 Section "Quality Control Services" for general inspection requirements.

1.2 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if:
   1. The estimated quantities of Work required by the Contract Documents are increased or decreased.
   2. If no estimate of quantity is given in the bidding documents for inclusion in the base bid.
   3. If the Owner, at his discretion, requests that work related to the unit price be performed.

1.3 PROCEDURES

A. Unit prices include all necessary labor, material, equipment cost for delivery, installation, insurance, overhead, profit, and applicable taxes.

B. Within 15 days of the date of commencement of work, each Prime Contractor shall prepare a schedule of unit prices as established in their Bid and Contract Award. Schedule shall indicate generic name, unit of measurement, price per unit, related specification section and subcontractor assigned to work. Distribute schedule to Owner, Construction Manager, Architect, and each entity involved in performance of work, where established unit prices could possibly come into force and effect.

C. Measurement and Payment: Refer to the Bid Form for unit of measurement to be used when creating unit prices. All work performed by unit price shall be performed only at the request of the Owner or Construction Manager/Architect, and shall be performed under the supervision of the construction manager. Tickets or other previously agreed upon documentation of the Work shall be submitted to, and approved by, the construction manager at the end of each day. Work performed without previous requests or approval by the Owner or construction manager, or payment requests for work without appropriate documentation and approvals may be denied for payment at the discretion of the Owner.

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~~D.~~ Refer to individual technical specification sections and drawings for required quality of work, standards, and basis of design when establishing unit prices. The requirements of the Contract Documents shall govern the work performed by unit price, as with any other portion of the work on the project, and therefore should also govern the content and compilation of the unit prices.

E. The Owner reserves the right to reject the Contractor's measurement of work performed by unit price, and to have this work measured by an independent surveyor acceptable to both the Contractor and the Owner. If the measurement of work established by the independent surveyor is found to validate the measurement of the Contractor, the Owner shall bear the cost of the independent surveyor. If the measurement of work established by the independent surveyor is found to refute the measurement of the Contractor, the Contractor shall bear the cost of the independent surveyor.

F. Schedule: A "Unit Price Schedule" is included at the end of this Section. Contractors shall complete all unit prices applicable to their prime contract. Specification Sections referenced in the Schedule contain requirements for materials described under each unit price.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 UNIT PRICE SCHEDULE – GENERAL CONSTRUCTION

A. Unit Price GC-01: Sealing of floor cracks

1. Description: Provide sealing of floor cracks in addition to quantities indicated in Dayrooms B205, B215, B226, B236.

2. Unit of Measurement: Per Lineal Foot

B. Unit Price GC-02: Exterior Sealants

1. Description: Provide exterior sealants at control or expansion joints, and around windows, doors and other openings.

2. Unit of Measurement: Per Lineal Foot

C. Unit Price GC-03: Security Ceiling

1. Description: Remove and reinstall security ceiling

2. Unit of Measurement: Per Square Foot

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D. Unit Price GC-04: Detention Door Locks
   1. Description: Provide Folger Adams Electric Locks as described in the Detention Hardware Specification.
      a. Folger Adams 120 Series Lock including connection plug, latch and locking mechanism, and strike plate.
      b. Folger Adams NS400 Series Lock including connection plug, latch and locking mechanisms and strike plate.
   2. Description: Provide Folger Adams Mechanical Locks as described in the Detention Hardware Specification.
      a. Folger Adams 10 Series Locks including latch and locking mechanism and strike plate.
      b. Folger Adams 80 Series Locks including latch and locking mechanism and strike plate.
   3. Unit of Measurement: Per Lock Set/Door

E. Unit Price GC-05: Replace Asphalt Shingles in Kind
   1. Description: Furnish and Install Replacement Shingles on the asphalt roof areas of the existing building where shingles are found to be missing or damaged.
   2. Unit of Measurement: Per Square Foot

F. Unit Price GC-06: Replace Lightening Arrestor Points in Kind
   1. Description: Where Points are found to be missing or damaged, replace points in kind.
   2. Unit of Measurement: Per Point

3.2 UNIT PRICE SCHEDULE – PLUMBING CONSTRUCTION

A. Unit Price PC-01: Security Sprinkler Heads

   1. Description: Provide additional security sprinkler heads

   2. Unit of Measurement: Per head.

END OF SECTION 01 22 00

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SECTION 01 23 00 - ALTERNATES

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for Alternates.

B. Definition: An Alternate is an amount proposed by Bidders and stated on the Bid Form for certain construction activities defined in the Bidding Requirements that may be added to or deducted from Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems or installation methods described in Contract Documents.

C. Coordination: Coordinate related Work and modify or adjust adjacent Work as necessary to ensure that Work affected by each accepted Alternate is complete and fully integrated into the project. Costs for the coordination, modification, or adjustment necessary for each alternate are included in the costs for each Alternate.

D. Notification: Immediately following the award of the Contract, prepare and distribute to each party involved, notification of the status of each Alternate. Indicate whether Alternates have been accepted, rejected or deferred for consideration at a later date. Include a complete description of negotiated modifications to Alternates.

E. Schedule: A "Schedule of Alternates" is included at the end of this Section. Specification Sections referenced in the Schedule contain requirements for materials and methods necessary to achieve the Work described under each Alternate.
   1. Include as part of each Alternate, miscellaneous devices, accessory objects and similar items incidental to or required for a complete the work whether or not mentioned as part of the Alternate.

PART 2 PRODUCTS (Not Applicable).

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PART 3 EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. GC-01: Repainting Barrel Vault Standing Seam Metal Roofs

Provide lump sum price for cleaning, surface rust removal, preparation, priming and finish painting of approximately 885 square feet of existing barrel vault roofs.

END OF SECTION 01 23 00

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SECTION 01 25 00 - PRODUCT SUBSTITUTIONS

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made after award of the Contract.

B. The Construction Schedule and the Schedule of Submittals are included under Section "Submittals."

C. Standards: Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

D. Procedural requirements governing the Contractor's selection of products and product options are included under Section "Materials and Equipment."

1.2 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:
   1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, are considered as included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.
   2. Revisions to Contract Documents requested by the Owner or Architect.
   3. Specified options of products and construction methods included in Contract Documents.
   4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.3 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received within 15 days after commencement of the Work. Requests received more than 15 days after commencement of the Work may be considered or rejected at the discretion of the Architect.
   1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
   2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete

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documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
b. Samples, where applicable or requested.
c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.
e. A statement indicating the substitution's effect on the Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
f. Cost information, including a proposal of the net change, if any in the Contract Sum.
g. Certification by the Prime Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.

3. Architect's Action: Within one week of receipt of the request for substitution, the Architect will request additional information or documentation necessary for evaluation of the request. Within 2 weeks of receipt of the request, or one week of receipt of the additional information or documentation, which ever is later, the Architect will notify the Prime Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance will be in the form of a Change Order.
   a. The Architect will review each request for substitution only once. The Prime Contractor will be required to reimburse the Architect at his hourly rate, for any reviews which are required, or requested, beyond the initial review.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 SUBSTITUTIONS

A. Substitutions may be permitted by the Architect, if, in his opinion, the requirements of the proposed substitution comply with the requirements specified for the material, article or piece of equipment; however, the Architect is not required to permit substitution pursuant to the

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case of Whitten Corporation vs. Paddock, Incorporated, United States District Court, Massachusetts, April 12, 1974, affirmed by the Federal First Circuit Court, December 14, 1974, and the United States Supreme Court, 1988.

B. The Architect has no obligation, after award of contract, to consider any brand other than those named in the Contract Documents. However, the Prime Contractor may submit substitutes to the Architect for review, fully documented and certified, and accompanied by his proposal for a deduction in the Contract Sum.

C. Conditions: The Prime Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
   1. Extensive revisions to Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of Contract Documents.
   3. The request is timely, fully documented and properly submitted.
   4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
   5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
   6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
   7. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.
   8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Prime Contractor certifies that the substitution will overcome the incompatibility.
   9. The specified product or method of construction cannot be coordinated with other materials, and where the Prime Contractor certifies that the proposed substitution can be coordinated.
   10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
   11. Where a proposed substitution involves more than one prime Contractor, each Contractor shall cooperate with the other Contractors involved to coordinate the Work, provide uniformity and consistency, and to assure compatibility of products.

D. The Prime Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval

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PROJECT NAME: _____

USA PROJECT #: _____

CONTRACT NO. _____

SUBSTITUTION NO. _____

REQUEST FOR SUBSTITUTION

Submit a copy of this form for each requested substitution. Fill in all blanks, check all boxes that apply and attach all necessary supporting data.

Specified Item: _____

Specification Section(s)/Paragraph(s): _____

Drawing Number(s): _____

Proposed Substitute: _____

(include, as applicable, manufacturer's name & address, trade name & model number of product and name of fabricator or supplier)

Reason for Proposed Substitution: _____

_____

_____

Net Change to Contract Sum: ☐No Change ☐Deduct $_____ ☐Add $

Change to Contract Time: ☐No Change ☐_____ Days ☐

The following required supporting documents are attached (Check all that apply):

☐Complete Product Data

☐Itemized comparison of properties of proposed product to specified product.

☐List of other projects on which proposed has been used, with project name, design professional's name and owner contact.

☐List of maintenance services and replacement materials available.

☐Statement of effect of substitution on construction schedule.

☐Description of change that will be required in other work or products if substitute product is approved.

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REQUEST FOR SUBSTITUTION

The undersigned testifies that he/she:

- Is submitting this substitution request within the limits set forth in the Contract Documents.
- Has investigated the proposed product and determined that it is equal or better than the specified product.
- Will provide the same warranty for the proposed product as for the specified product.
- Will coordinate installation and make other changes as required for the work to be complete in all respects, including: (a) redesign and (b) additional components and capacity required by other work affected by the change.
- Waives all claims for additional costs for evaluation of the substitution request, redesign if required, and reapproval by authorities having jurisdiction, if required.
- Waives reimburse the Owner for additional costs for evaluation of the substitution request, redesign if required, and reapproval by authorities having jurisdiction, if required.

Contractor's Signature: _____

Typed or Printed Name: _____

Title: _____

Company: _____

Address: _____

Phone Number: _____

Owner Approval: _____ Date: _____

Construction Manager Approval: _____ Date: _____
If Applicable

USA Architects, P.A. Approval: _____ Date: _____

Consulting Engineer Approval: _____ Date: _____

END OF SECTION 01 25 00

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SECTION 01 26 00 - MODIFICATION PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 01 Section "Submittals" for requirements for the Contractor's Construction Schedule.
   2. Division 01 Section "Application for Payment" for administrative procedures governing applications for payment.
   3. Division 01 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.2 CHANGE ORDER PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
   1. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.
   2. Unless otherwise indicated in the proposal request, within 20 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
      a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
   1. Include a statement outlining the 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 Contract Time.
   2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

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3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts, if allowed and or applicable.
4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.

C. Proposal Request Form: Use AIA Document G 709 for Change Order Proposal Requests.

1.3 CHANGES IN THE WORK

A. Tabulate cost breakdown into subcontracts and trades for each of which the quantity, labor, material, other cost and resulting final cost per unit shall be indicated. Quantity, labor, material, other cost and cost per unit generally include but are not necessarily limited to the following:
1. Quantity; total number of items for each portion or unit of work as determined from the change.
2. Labor; on site labor for the handling and installation of material from point of delivery at site.
3. Material; cost of material as delivered to the site for installation and erection.
4. Other cost; rental equipment, depreciation, site office, administration, overhead and profit, testing survey and layout, samples and all other costs not included in labor and material.

B. When a change in the work includes a category or categories of work both added to and deducted from the Contract, the total quantities of added work and of deleted work shall be determined separately for each category and the appropriate unit price or net cost of the work shall be applied to the difference between the two total quantities.

C. Unit prices shall be inclusive of all costs and shall be applied to units of measure as defined in the specifications for each category of work.

D. For all extra work performed by the Contractor, the gross cost to the Owner shall include the net cost of the work to the Contractor plus an allowance for overhead and profit not to exceed, (See General Conditions, Article 7), of the net cost.

E. For all extra work performed by a Subcontractor, the gross cost to the Owner shall include the net cost of the work by the Subcontractor plus an allowance for overhead and profit not to exceed, (See General Conditions, Article 7), of his net cost, plus the General Contractor's overhead and profit not to exceed, (See General Conditions, Article 7), of the Subcontractor's net cost. In no case shall the total allowance for overhead and profit exceed, (See General Conditions, Article 7), of the net cost of the work.

F. Net cost of extra work shall be the actual or prorated cost of:
1. In all cases to be in compliance with the General Conditions, Article 7.

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G. Gross costs shall be net costs plus allowances listed in the General Conditions, Article 7. Such allowances being the inclusion of all costs for construction superintendent, supervision, engineering, overhead, profit, administrative and site office expenses and all other general expenses.

1.4 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.5 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701, as provided in the Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 26 00

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SECTION 01 29 00 - APPLICATIONS FOR PAYMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

1. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.

1.2 SCHEDULE OF VALUES

A. The Contractor shall coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.

1. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
    a. Contractor's construction schedule.
    b. Application for Payment form.
    c. List of subcontractors.
    d. Schedule of alternates.
    e. List of products.
    f. List of principal suppliers and fabricators.
2. Submit the Schedule of Values to the Construction Manager/Architect and Owner at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.

B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.

1. Identification: Include the following Project identification on the Schedule of Values:
    a. Project name and location.
    b. Name of the Architect.
    c. Project number.
    d. Contractor's name and address.
    e. Date of submittal.
2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
    a. Generic name.
    b. Related Specification Section.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that have affected value.
    g. Dollar value.
    h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.

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3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
6. Tabulate schedule into subcontracts and trades for each of which the quantity, labor, materials, other cost and resulting final cost per unit shall be indicated. Quantity, labor, materials, other cost and cost per unit generally include but are not necessarily limited to the following:
    a. Quantity; total number of times for each portion or unit of work as determined from the Contract Documents.
    b. Labor; on site labor for the handling and installation of material from point of delivery at site.
    c. Material; cost of materials as delivered to the site for installation and erection.
    d. Other cost; rental equipment, depreciation, site office, administration, overhead and profit, testing, survey and layout, samples and all other costs not included in labor and material.
    e. Cost per unit; total of labor, material and other Cost for each portion or unit of work derived from the total quantity of same.

1.3 PROGRESS PAYMENTS

A. Based upon application for payments submitted to the Construction Manager, Architect and Owner, by the Contractor, on the specified day of each month and Certificate of Payment certified by the Construction Manage/Architect, the Owner will make progress payments on account of the Contract Sum to the Contractor as follows:
    1. In making progress payments, there shall be retained ten percent (10%) of the approved amount, until 50% of the project is completed. When 50% of the project has been completed retainage shall be reduced to 5% provided the Construction Manager and Architect approve the Application for Payment, the Contractor is making satisfactory progress, and the is no specific cause for greater withholding.
    2. For each day delay in the Contractor's submission of an application for payment acceptable to the Construction Manager/Architect and Owner, the Owner may delay one day in making his progress payment.

1.4 APPLICATIONS FOR PAYMENT:

A. The Contractor's monthly application for payment shall be in the same schedule form as the schedule of values, reflecting the same items. Unit costs shall be realistic for their part of the work.
B. Each Application for Payment shall be consistent with previous applications and payments as approved by and paid for by the Owner.
    1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.

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C. Payment Application Times: Each Payment Application shall be made at the end of each month and shall be based upon the entire month's completed work. A "pencil copy" shall be submitted on or about the 25th of each month showing the projected completion of work for the month, for review.

D. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.

E. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.
   1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

F. Transmittal: Submit 3 executed copies of each Application for Payment to the Owner by means ensuring receipt within 24 hours; each copy shall be complete, including waivers of lien and similar attachments, when required.
   1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Architect.

G. Waivers of Mechanics Lien: Submit waivers of mechanics lien from every entity who may lawfully be entitled to file a mechanics lien arising out of the Contract, and related to the Work covered by the payment.
   1. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.
   2. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment.
   1. Include the following:
      a. List of subcontractors.
      b. List of principal suppliers and fabricators.
      c. Schedule of Values.
      d. Contractor's Construction Schedule (preliminary if not final).
      e. Schedule of principal products.
      f. Schedule of unit prices.
      g. Submittal Schedule (preliminary if not final).
      h. List of Contractor's staff assignments.
      i. List of Contractor's principal consultants.
      j. Copies of building permits
      k. Copies of authorizations and licenses from governing authorities for performance of the Work.
      l. Initial progress report.
      m. Report of pre-construction meeting.
      n. Certificates of insurance and insurance policies.

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o. Performance and payment bonds (if required).
p. Data needed to acquire Owner's insurance.

I. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment.
1. Include the following:
a. Completion of Project closeout requirements.
b. Completion of punch list items.
c. Transmittal of required Project construction records to Owner.
d. Proof that taxes, fees and similar obligations have been paid.
e. Removal of temporary facilities and services.
f. Removal of surplus materials, rubbish and similar elements.
g. Contractor's Affidavit of Payments of Debts & Claims - AIA Document G706.
h. Contractor's Affidavit of Release of Liens - AIA Document G706A.
i. Consent of Surety to Final Payment - AIA Document G707.

1.5 WAIVER OF LIENS

A. The Contractor, for himself, and for all Subcontractors and material men, agrees that no mechanic's lien or other claim shall be filed or maintained by the Contractor or by any Subcontractor, material man, laborer or any other person whatsoever for, or on account of any work performed or materials furnished under this Contract. This agreement shall execute and deliver a separate waiver of Liens in form and substance satisfactory to the Owner contemporaneously with the execution of the Owner-Contractor Agreement and before any work is begun at the site.

B. In every subcontract entered into by the Contractor after execution of this Contract or in connection herewith, the Contractor shall incorporate a provision, similar to the foregoing paragraph, to the effect that neither the Subcontractor nor any party acting through or under him shall file or maintain any mechanic's lien or other claim against the Owner in connection with the Work.

1.6 RELEASE OF PAYMENT

A. Following receipt of this Application for Payment by the Construction Manager/Architect and review thereof, the Architect, if satisfied, shall authorize payment of that bill by executing a Project Certification for Payment to the township Administrator and Chief Financial Officer acting on behalf of the Owner. Payment shall be made by the Township to the Contractor within 30 days of the Construction Manager’s receipt of the Application for Payment for Work unless there is an Owner objection pursuant to paragraph “B” below.

B. The Owner shall have the right to withhold all or a portion of the Application for Payment amounts if, within 20 days of receipt of the Application for Payment for Work by the Construction Manager, the Architect submits, on behalf of the Owner, a written statement to the Contractor explaining the reasons for withholding such sum.

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PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 29 00

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SECTION 01 31 13- PROJECT COORDINATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
   1. Coordination as a responsibility of each Prime Contractor.
   2. Special and exclusive responsibility of the General Contractor for coordination.
   3. Administrative and supervisory personnel.
   4. General installation provisions.
   5. Cleaning and protection.

B. Progress meetings, coordination meetings and pre-installation conferences are included in Section "Project Meetings".

C. Requirements for the Contractor's Construction Schedule are included in Section "Submittals".

1.2 COORDINATION

A. Coordination: Each Contractor shall coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specifications that are dependent upon each other for proper installation, connection, and operation. The Owner, Architect and or Engineer shall have no duty to coordinate the work of any separate contractor which shall remain the exclusive obligation of the General Contractor.
   1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
   2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

1.3 SPECIAL AND EXCLUSIVE RESPONSIBILITIES OF THE GENERAL CONTRACTOR AS PRINCIPAL PROJECT COORDINATOR

A. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.
   1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.

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B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project Close-out activities.

C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
   1. Salvage materials and equipment involved in performance of, but not actually incorporated in, the w Work. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.4 SUBMITTALS

A. Coordination Drawings: The General Contractor shall prepare and submit coordination Drawings based on appropriate information from each prime, where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
   1. Show the interrelationship of components shown on separate Shop Drawings.
   2. Indicate required installation sequences.
   3. Comply with requirements contained in Section "Submittals."

B. Staff Names: Within 15 days of Notice to Proceed, submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
   1. Post copies of the list in the Project meeting room, the temporary field office, and each temporary telephone.

PART 2 PRODUCTS (Not Applicable).

PART 3 EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

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B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work. Secure Work true to line and level. Allow for expansion and building movement.

E. Visual Effects: Provide uniform joint widths in exposed Work. Arrange joints in exposed Work to obtain the best visual effect. Refer questionable choices to the Architect for final decision.

F. Recheck measurements and dimensions, before starting each installation.

G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.

I. Mounting Heights: Where mounting heights are not indicated, install individual components at standard mounting heights recognized within the industry for the particular application indicated. Refer questionable mounting height decisions to the Architect for final decision.

3.2 CLEANING AND PROTECTION

A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

B. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

a. Excessive static or dynamic loading.
b. Excessive internal or external pressures.
c. Excessively high or low temperatures.
d. Thermal shock.
e. Excessively high or low humidity.
f. Air contamination or pollution.
g. Water or ice.

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h. Solvents, Chemicals.
i. Light, Radiation.
j. Puncture, Abrasion.
k. Heavy traffic.
l. Soiling, staining and corrosion.
m. Bacteria.
n. Rodent and insect infestation.
o. Combustion.
p. Electrical current.
q. High speed operation,
r. Improper lubrication,
s. Unusual wear or other misuse.
t. Contact between incompatible materials.
u. Destructive testing.
v. Misalignment.
w. Excessive weathering.
x. Unprotected storage.
y. Improper shipping or handling.
z. Theft.
aa. Vandalism.

END OF SECTION 01 31 13

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SECTION 01 31 19 - PROJECT MEETINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
   1. Pre-Construction Conference.
   2. Pre-Installation Conferences.
   3. Coordination Meetings.
   4. Progress Meetings.

1.2 PRE-CONSTRUCTION CONFERENCE

A. The Construction Manager shall schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than five (5) days after the Notice to Proceed and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.

B. Attendees: The Owner, Construction Manager, Architect and their consultants, Prime Contractors and their superintendents, major Subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.

C. Agenda: Attendees shall discuss items of significance that could affect progress including such topics as:
   1. Prime Contractor Construction Schedules and Overall Project Schedule.
   2. Critical Work sequencing.
   3. Designation of responsible personnel.
   4. Procedures for processing field decisions and Change Orders.
   5. Procedures for processing Applications for Payment.
   6. Distribution of Contract Documents.
   7. Submittal of Shop Drawings, Product Data and Samples.
   8. Preparation of Record Documents.
   9. Use of the premises.
   10. Office, Work and storage areas.
   11. Equipment deliveries and priorities.
   12. Safety procedures.
   13. First aid.
   14. Security.
   15. Housekeeping.
   16. Working hours.

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1.3 PRE-INSTALLATION CONFERENCES

A. Prime Contractors shall conduct Pre-installation conferences at the Project site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Construction Manager and Architect of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each Pre-installation conference, including , but not limited to, requirements for:
    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases
    e. Deliveries.
    f. Shop Drawings, Product Data and quality control Samples.
    g. Possible conflicts.
    h. Compatibility problems.
    i. Time schedules.
    j. Weather limitations.
    k. Manufacturer's recommendations.
    l. Compatibility of materials.
    m. Acceptability of substrates.
    n. Temporary facilities.
    o. Space and access limitations.
    p. Governing regulations.
    q. Safety.
    r. Inspection and testing requirements.
    s. Required performance results.
    t. Recording requirements.
    u. Protection.
2. Prime Contractor shall record significant discussions and agreements and disagreements of each conference, along with the approved schedule. Distribute the record of the meeting to everyone concerned, promptly, including the Architect.
3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.4 COORDINATION MEETINGS

A. The Construction Manager shall conduct Project coordination meetings at regularly scheduled times convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.

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B. The Construction Manager shall request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved.

C. The Construction Manager will record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.5 PROGRESS MEETINGS

A. The Construction Manager will conduct progress meetings at the Project site every other week, and shall notify the Owner, Architect, Engineers, and Prime Contractors of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
   1. Each Prime Contractor shall attend each meeting for the duration of the Contract. The Construction Manager will record results of meetings and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

B. Attendees: In addition to representatives of the Owner, Construction Manager, Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.

C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
   1. The Project Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Project Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
   2. Review the present and future needs of each entity present, including such items as:
      a. Interface requirements.
      b. Time.
      c. Sequences.
      d. Deliveries.
      e. Off-site fabrication problems.
      f. Access.
      g. Site utilization.
      h. Temporary facilities and services.
      i. Hours of Work.
      j. Hazards and risks.
      k. Housekeeping.
      l. Quality and Work standards.
      m. Change Orders.
      n. Documentation of information for payment requests.

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D. Reporting: No later than three (3) days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
   1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 31 19

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SECTION 01 33 00 – SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;
   1. Each Prime Contractor's construction schedule.
   2. The Overall Project Schedule.
   3. Submittal schedule.
   4. Daily construction reports.
   5. Shop Drawings.
   6. Product Data.
   7. Samples.

B. Administrative Submittals: Refer to other Division-01 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
   1. Permits.
   2. Applications for payment.
   3. Performance and payment bonds.
   4. Insurance certificates.
   5. List of Subcontractors.

C. The Schedule of Values submittal is included in Section "Applications for Payment."

D. Inspection and test reports are included in Section "Quality Control Services."

1.2 SUBMITTAL PROCEDURES

A. Shop drawings, product data and samples will not be processed by Construction Manager/Architect until list of subcontractors, material suppliers and fabricators is submitted as required by General Conditions.

B. All Submittals shall be made within 90 Days of the Notice to Proceed.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities and with the work of other Prime Contractors. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

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a. The Construction Manager/Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
   a. Allow two weeks for initial review. Allow additional time if processing must be delayed to allow coordination with subsequent submittals. The Architect will promptly advise the Construction Manager/Prime Contractor when a submittal being processed must be delayed for coordination.
   b. If an intermediate submittal is necessary, process the same as the initial submittal.
   c. Allow two weeks for reprocessing each submittal.
   d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

1.3 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit through Procore, one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

1.4 CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Each prime contractor shall prepare a fully developed, horizontal bar-chart type construction schedule, and submit same to the General Contractor, as Lead Prime Contractor, within 15 days of the date established for "Commencement of the Work". The General Contractor will appropriately adjust each primes schedule to incorporate it into the Overall Project Construction Schedule as indicated below:
   1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values".
   2. Within each time bar indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
   3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
   4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.
   5. Coordinate the construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
   6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

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B. Phasing: Provide notations on the schedule to show how the sequence of the Work is affected by requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including testing and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

F. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting. Each Prime Contractor shall provide an updated schedule to the General contractor for updating of the Overall Project Schedule.

1.5 SUBMITTAL SCHEDULE

A. After development and acceptance of the construction schedule and the Overall Project Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the construction schedule. All submittals shall be made within 90 days of the date of Notice to Proceed.
   1. Coordinate submittal schedule with the list of subcontracts, schedule of values and the list of products as well as the construction schedule.
   2. Prepare the schedule in chronological order; include submittals required during the first 90 days of construction. Provide the following information:
      a. Scheduled date for the first submittal.
      b. Related Section number.
      c. Submittal category.
      d. Name of subcontractor.
      e. Description of the part of the Work covered.

B. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

1.6 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Construction Manager/Architect at weekly intervals:

   1. List of subcontractors at the site.
   2. Approximate count of personnel at the site.

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3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, losses.
7. Meter readings and similar recordings.
8. Emergency procedures.
9. Orders and requests of governing authorities.
10. Change Orders received, implemented.
11. Services connected, disconnected.
12. Equipment or system tests and start-ups.
13. Partial Completions, occupancies.
14. Substantial Completions authorized.

1.7 SHOP DRAWINGS

A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.

B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
1. Dimensions.
2. Identification of products and materials included.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
7. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
1. Preparation of coordination Drawings is specified in section "Project Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
2. Submit coordination Drawings for integration of different construction elements. Show sequences and relationships of separate components to avoid conflicts in use of space.

1.8 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."

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1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
   a. Manufacturer's printed recommendations.
   b. Compliance with recognized trade association standards.
   c. Compliance with recognized testing agency standards.
   d. Application of testing agency labels and seals.
   e. Notation of dimensions verified by field measurement.
   f. Notation of coordination requirements.
2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
3. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
4. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
   a. Do not proceed with installation until an applicable copy of Product Data applicable is in the installer's possession.
   b. Do not permit use of unmarked copies of Product Data in connection with construction.

1.9 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern. All samples are to be original physical samples or color charts. Scans, e-mails, copies, printed, or other similar types of sample submittals will be rejected.
   1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Include the following:
      a. Generic description of the Sample.
      b. Sample source.
      c. Product name or name of manufacturer.
      d. Compliance with recognized standards.
      e. Availability and delivery time.
   2. 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 the final submittal and the actual component as delivered and installed.
      a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
      b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
   3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.

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a. Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and other action.

4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
   b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field Samples specified in individual Sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
   a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.10 ARCHITECT'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
1. Compliance with specified characteristics is the General Contractor’s responsibility.
2. The Architect’s review is for a product’s general conformance with the contract documents. The Architect’s approval does not relieve the Contractor from providing products or work in conformance with the Contract Documents.
3. Regardless of the approval of a submittal by the Architect, all coordination of work related to the submittal remains the responsibility of the Contractor.
4. The Architect reserves the right to reject incomplete submittals, or submittals which do not clearly portray the purpose of the product or drawing.

B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp.

1.11 CONSTRUCTION PHOTOGRAPHY

A. Within two weeks prior to the commencement of the Work, and on a monthly basis thereafter until substantial completion of the Work, the Contractor shall provide color photographs indicating the project progress from a professional photography service employed by the Contractor.
1. Engage a qualified commercial photographer to take construction photographs.
2. Photographic Film Prints shall be 2-1/4” x 2-3/4”, or digital images.

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3. Unless otherwise directed, date and time stamp each photograph as it is being taken so stamp is integral to the photograph.
4. A maximum of eight individual photographs will be provided in views selected by the Construction Manager or Architect.
5. Four copies of each photograph shall be developed in 8” x 10” color format. Each photograph will be mounted loosely within a clear plastic sheet protector that allows attachment to a standard 3-hole binder.
6. The Contractor will retain one copy of each photograph for their records and distribute one copy of each photograph to the Owner, Architect and Construction Manager.

B. Project Completion Photographs
1. At the completion of the Work, including punch list items, the Contractor shall employ a professional architectural photographer to provide color photographs of ten (10) exterior views and five (5) interior views selected by the Architect and/or Project Manager.
2. Three copies of each photograph shall be developed in 8” x 10” color format. Each photograph will be mounted loosely within a clear plastic sheet protector that allows attachment to a standard 3-hole binder.
3. The Contractor shall distribute one copy of each photograph to the Owner, Architect and Construction Manager.

PART 2 PRODUCTS (Not Applicable).

PART 3 EXECUTION (Not Applicable).

END OF SECTION 01 33 00

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SECTION 01 40 00- QUALITY CONTROL SERVICES

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for quality control services.

B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Owner, Construction Manager and/or Architect.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
   1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
   2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for the Contractor to provide quality control services required by the Owner, Construction Manager, Architect, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 RESPONSIBILITIES

A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Owner's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor. Costs for these services shall be included in the Contract Sum.
   1. The Contractor shall employ and pay an independent agency, to perform specified quality control services.
      a. Where the Owner has engaged a testing agency or other entity for testing and inspection of a part of the Work, and the Contractor is also required to engage an entity for the same or related element, the Contractor shall not employ the entity engaged by the Owner, unless otherwise agreed in writing with the Owner.

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2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
    a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility.
3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
    a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
    b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
    c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
    d. Security and protection of samples and test equipment at the Project site.

B. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
    a. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
    b. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
    c. The agency shall not perform any duties of the Contractor.

C. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.
    1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

1.3 SUBMITTALS

A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Construction Manager/Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
    1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
    2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:

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a. Date of issue.
b. Project title and number.
c. Name, address and telephone number of testing agency.
d. Dates and locations of samples and tests or inspections.
e. Names of individuals making the inspection or test.
f. Designation of the Work and test method.
g. Identification of product and Specification Section.
h. Complete inspection or test data.
i. Test results and an interpretation of test results.
j. Location of sample or test in project.
k. Ambient conditions at the time of sample-taking and testing.
l. Professional opinion as to whether Work complies with Contract Documents requirements.
m. Name and signature of laboratory inspector.
n. Recommendations on retesting.

1.4 QUALITY ASSURANCE

A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

1.5 TRADESMEN & WORKMANSHIP

A. Ensure that tradesmen performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

PART 2 PRODUCTS (Not Applicable).

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PART 3 EXECUTION

3.1 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

3.2 REPLACEMENT OF WORK

A. Within 24 hours after rejection of work pursuant to the General Conditions, remove all materials and equipment so rejected and immediately replace work, at the Contractor's cost, to the satisfaction of the Construction Manager/Architect. Should the work of the Owner or other Contractors be damaged by such removal or replacement, the Contractor shall reimburse the Owner or other Contractors for all costs incurred for correcting damage.

END OF SECTION 01 40 00

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SECTION 01 42 19 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect," "requested by the Architect," and similar phrases.

D. Approve: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

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

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

I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
   1. The term "experienced," when used with the term "Installer," means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
   2. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a

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corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

3. Assignment of Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.
    a. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.2 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 50-Division format and MASTERFORMAT numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mode are to be performed by the Contractor.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

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B. Publication Dates: Comply with the standard in effect as of the date of the Contract Documents.

C. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

D. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision.

1.4 SUBMISSIONS

A. For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01 42 19

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 PART 1 - GENERAL

1.1 SUMMARY

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

B. Where not specifically assigned to one contractor or all contractors, the requirements of this specification pertain to all contractors.

C. Related Requirements:

1. Section 01 11 01 "Summary of Work – Multiple Prime Contracts" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

B. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Internet Service: WIFI based Internet Service from Owner’s existing system is available in the Indoor Recreation, Room A130 portion of the building for use without metering and without payment of use charges. ALL Contractors are required to provide their own internet/WIFI service at their cost for their construction operations. No hard connections are available on site. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel. The General Contractor, with input from each prime contractor, shall create, coordinate and submit the site utilization plan to the Owner within 15 days of the date established for the commencement of work.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, each Prime Contractor shall submit a schedule indicating

implementation and termination dates of each and any temporary utility extensions required from the Owner's existing utilities.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.
   1. The Project Identification Sign will be provided by the Owner.
   2. The General Contractor, as the Lead Prime Contractor, shall provide general directional, safety, emergency, and any other project wide signage needed.
   3. Each Prime Contractor shall provide signage specific to their temporary facilities or work.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program. The General Contractor shall be responsible for creating, implementing and managing the fire prevention program for the Project, and for temporary fire extinguishing equipment common to the building and site. Each Prime Contractor shall be responsible for fire safety, and extinguishing equipment in their trailers, offices and storage spaces.

E. Moisture and Mold-Protection Plan:
   1. The General Contractor shall be responsible for creating and distributing a Moisture and Mold Prevention Plan for use by all contractors.
   2. The Plan shall be approved by the Owner, and shall contain the requirements described in this Section and also Section 3.6 of this specification.
   3. The General Contractor shall be responsible for overall weathertightness of the building, and for managing the interior environment of the building to prevent moisture and mold growth.
   4. Each Prime Contractor shall be responsible for protecting their own materials, work and installations from weather, moisture or mold; whether within the building or in other storage, and for complying with the requirements of the Moisture and Mold Prevention Plan.
   5. Each Prime Contractor shall be responsible for notifying and coordinating their work with all other contractors who may be affected by their work.
   6. The Plan shall describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
   7. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
   8. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
   9. Indicate methods to be used to avoid trapping water in finished work.

F. Dust and HVAC-Control Plan: The Mechanical Contractor, with input from the General Contractor shall submit a coordination drawing and narrative that indicates the dust- and HVAC-

control measures proposed for use, proposed locations, and proposed time frame for their operation. The permanent existing building HVAC system will be available for use during the project within parameters allowed by and agreed to by the Owner. Include the following in the Control Plan:

1. Measures to be taken to protect and restore the HVAC system to its pre-project condition throughout and at the conclusion of the project.
2. Locations of dust-control partitions at each phase of work.
3. HVAC system isolation schematic drawing.
4. Location of proposed air-filtration system discharge.
5. Waste-handling procedures.
6. Other dust-control measures.

G. Noise Vibration and Control Plan: All Prime Contractors shall submit a Noise and Vibration Control Plan identifying construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:

1. Methods used to meet the goals and requirements of Owner.
2. Timeframes and locations of the work.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized-steel bases for supporting posts. Posts shall be adequately stabilized.

B. The General Contractor shall be responsible for providing a continuous site construction fence completely encircling the project site with adequate gates in size and quantity to facilitate the work. The proposed extent of fence and gates are shown on the Civil Site Plan.

C. The construction fence shall be shown on the site logistics plan and be approved by the Owner prior to erection.

D. Provide gate locks acceptable to the owner and provide keys to the Owner and Owner's representatives.

2.2 TEMPORARY FACILITIES

A. Field Offices: It is the intent of the Owner to provide space in a designated area of the existing building for use by contractors for field offices, including the Common Use Field Office described below. This designated area may or may not be a common room for use by multiple contractors. It is the preference of the Owner for Contractors to use the space in the building for their offices, but it does not preclude a contractor from providing a field office separate from the building.
   1. Where a separate field office is provided, it shall be a prefabricated or mobile unit with serviceable finishes, temperature controls, and foundations adequate for normal loading.
   2. Each Prime Contractor shall be responsible for their own field office, including utilities and furnishings, whether within the building or separate from the building.
   3. Each Prime Contractor shall be responsible for maintaining their office area in a clean and orderly manner and for the security of their furnishings and equipment.

B. Common-Use Field Office: The General Contractor shall provide a common use field office of sufficient size to accommodate the needs of the Owner, Architect, and other construction personnel and their office activities, and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

   1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
   3. Drinking water and private toilet.
   4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
   5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Each Prime Contractor shall provide sheds or containers sized, furnished, and equipped to accommodate materials and equipment for their construction operations.

1. Store combustible materials apart from building.
2. Each Prime Contractor shall be responsible for the security, safety, weathertightness, and integrity of its storage facilities.
3. Coordinate placement of storage facilities with the Site Utilization Plan and at locations which do not impede the coordination or flow of work.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: The Owner intends for the use of the permanent HVAC system, but in the event that the permanent HVAC system is not available, or supplemental conditioning is required, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: For use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 70 00 "Project Closeout."
4. Use and protection of the permanent HVAC system shall at all times comply with the Dust and HVAC Control Plan.
5. At all times, the Owner reserves the right to terminate use of the permanent HVAC system if the system is not being properly and adequately maintained and protected, if use of the systems is being abused, or if the Dust and HVAC Control Plan is not being followed.
6. Any damage to the system, equipment and components must be corrected to original pre-construction condition to the Owner's satisfaction and approval. The Mechanical Contractor shall be responsible for the cost of correcting any damage, unless it can be conclusively determined by the Owner that another contractor was responsible for specific damage. In that case, the offending contractor will be responsible for the cost of correcting that specific damage.

C. Air-Filtration Units: Where supplemental or portable units are required, primary and secondary HEPA-filter-equipped portable units with four-stage filtration shall be provided. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied or Completed Facilities: Prevent dust, fumes, and odors from entering occupied areas. Protect installed or completed work from damage.

1. Prior to commencing work, the Mechanical Contractor shall isolate the HVAC system in areas where work is to be performed in accordance with coordination drawings and the Dust and HVAC Control Plan.

   a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas where necessary to protect mechanical equipment.
   b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. The General Contractor shall be responsible for providing any temporary walls or other physical barriers required to isolate or protect portions of the facility where work has been completed or to isolate portions of the HVAC system.
3. Each Prime Contractor shall be responsible for protecting their installed work.
4. Perform daily construction cleanup and final cleanup.
   a. The General Contractor shall be responsible for overall and ongoing common building clean up throughout, and for housekeeping of office areas and sanitary facilities, however each Prime Contractor shall provide clean up in their specific areas of work, of debris and unused materials.
   b. The General Contractor is responsible for final cleaning and site clean up.

c. Each Prime Contractor shall be responsible for clean up and maintenance of their temporary facilities areas including complete clean-up upon removal of temporary facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service:
1. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
2. The Plumbing Contractor shall provide, maintain and remove temporary water services, including service to construction trailers. Installation/maintenance/removal of temporary service for trailers or other needs will be made at the contractor's cost. This is not an Owner's expense.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
2. The General Contractor shall provide and maintain adequate and gender specific temporary toilet facilities on site. For use by all contractors, the Owner and Owner's representatives.

D. Temporary Heating and Cooling: Provide temporary heating and cooling 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 that will not have a harmful effect on completed installations or elements being installed.

1. Existing heating and cooling systems in the building will be utilized when and to the extent needed and approved by the Owner for conditioning the building. Use of the system shall be in accordance with other requirements of this specification section and the contract documents. The Mechanical Contractor shall manage the use of the system in accordance with approved use plans.
2. Should it become necessary, the General Contractor shall provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
3. Should it become necessary, the General Contractor shall provide temporary heating systems when required to maintain ambient temperature levels to allow work to

proceed, as required to allow installation or application of finishes and their proper curing or drying, or if it is necessary to protect installed work from damage.

E. Electric Power Service:

1. The Electrical Contractor shall be responsible for providing all temporary electrical services required on and in the project site. This includes electrical service to all construction trailers and temporary facilities provided by other contractors. The Owner retains the right to control the amount of temporary power provided to temporary facilities, and to deny the installation of temporary power should the request be deemed excessive.

2. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
3. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

   a. Install electric power service overhead unless otherwise indicated.
   b. Connect temporary service to Owner's existing power source, as directed by Owner.
4. Since office space will be available in the building for this project, The Electrical Contractor shall be reimbursed by any contractor choosing to use a separate office trailer for the cost of providing electrical service to the trailer.

F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. The Electrical Contractor shall provide temporary lighting as described in this section for and common to the project.

2. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3. Install and operate temporary lighting throughout the building with adequate illumination to facilitate the progress of work, and observation and inspection thereof.

G. Electronic Communication Service: Provide secure internet connection on the project site.
1. Hard wired connection to local cable/internet service is not available at this site.
2. All Prime Contractors shall be responsible for their own internet and WIFI systems within their temporary facilities whether inside or outside the building. Coverage shall be to the extent necessary to support their workers throughout the building.
3. The General Contractor shall provide WIFI internet service for common meeting spaces and for use by the Owner and Architect when on site. Other than room A130, WIFI for owner/architect is only necessary in the trailer/Area used for meetings. It is not a necessity to provide WIFI throughout the entire facility just for the Owner/Architect.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Locate temporary facilities in accordance with the site logistics plan and so as not to impede any work.
3. Remove temporary facilities before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
4. Completely remove all temporary utilities associated with support facilities and restore site to a condition acceptable to the Owner, or as otherwise prescribed in the Contract Documents.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
3. The General Contractor shall remove snow and ice within the perimeter of the construction fence as required to minimize accumulation, and to maintain adequate and safe access to the site and building. The Owner will remove snow and ice outside of the fenced area.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Storage and Staging: Use designated areas of Project site for storage and staging needs.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water. The General Contractor shall be responsible for erosion and sedimentation control measures and for managing overall site dewatering and storm run off.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Each Prime Contractor shall be responsible for any de-watering associated with their work in coordination with the General Contractor.
3. The Project site is located within the Blue Marsh Watershed and all water leaving the project site must be properly controlled and cleaned in accordance with all Local, Commonwealth and Federal environmental control regulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. The Overall Project Identification Sign is being provided by the Owner.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.

b. Responsibility for signage shall be as described elsewhere in this Section.

3. Maintain and touch up signs, so they are legible at all times.
4. Provide and maintain directional, safety, emergency and other signage necessary for Project operations. Responsibility for signage is as described elsewhere in this Section.
5. Remove all signage prior to Project turnover to the Owner, or when replaced by permanent signage.
6. All signage is subject to approval by the Owner.

G. Waste Disposal Facilities:

1. The General Contractor shall provide and maintain waste disposal facilities common to the project and for use by all contractors.
2. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

H. Lifts and Hoists:

1. Each Prime Contractor shall provide facilities necessary for hoisting materials and personnel required to complete their work.
2. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
3. Coordinate the placement and use of lifts and hoists so as not to impede or damage the work of other contractors.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Site and Building Security: The General Contractor shall be responsible for maintaining a secure site and building, including the locking thereof at the conclusion of each work day.

B. Each Prime Contractor shall be responsible for securing and locking their individual trailers, equipment, and storage facilities.

C. Protection of Existing Facilities: Each Prime Contractor is responsible to protect existing vegetation, equipment, structures, utilities, and other improvements at the Project site and on adjacent properties, which could be affected by their work. Repair damage to existing facilities at no cost to the Owner.

D. Environmental Protection: Each Prime Contractor shall provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 11 01 "Summary 0f Work."

E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains. The General Contractor shall be responsible for all erosion and sedimentation control measures, and for managing and controlling storm and dewatering run off.

F. Pest Control: The General Contractor shall engage a pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, r a c o o n s and other pests, and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. All Prime Contractors are responsible for maintaining their work areas and temporary facilities so as not to attract or harbor pests, rodents or vermin.

H. Security Fence: Before construction operations begin, The General Contractor shall furnish and install security fence in a manner that will prevent people from easily entering the designated area except by entrance gates.

1. Extent of Fence: As indicated on Drawings.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish minimum one set of keys to Owner.
3. Maintain integrity of the fence throughout construction.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
~~1.~~ Responsibility for items in this section shall be as assigned elsewhere in this specification.

J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

K. 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 weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
2. Responsibility for temporary enclosures and protection of work shall be as described elsewhere in this specification.

L. Temporary Fire Protection: In accordance with the Fire Prevention Plan described elsewhere in this specification, The General Contractor shall install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 MOISTURE AND MOLD CONTROL

A. Comply with the Mold and Moisture Control Plan described elsewhere in this specification.

B. Conditioning of the building shall be as described elsewhere in this specification.

C. The General Contractor shall be responsible for maintaining overall weathertightness of the building, but that does not preclude each Prime Contractor from anticipating and protecting their own work from moisture or mold growth.

D. The following precautions and requirements shall be applicable to Each Prime Contractor throughout the project.
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.
6. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
7. Keep interior spaces reasonably clean and protected from water damage.
8. Periodically collect and remove waste containing cellulose or other organic matter.
9. Discard or replace water-damaged material.
10. Do not install material that is wet.
11. Discard and replace stored or installed material that begins to grow mold.
12. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
13. Control moisture and humidity inside building by maintaining effective dry-in conditions.
14. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
15. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of

exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

B. The Construction Schedule and the Schedule of Submittals are included under Section "Submittals."

C. Standards: Refer to Section "Definitions and Standards" for applicability of industry standards to products specified.

1.2 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
   1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
      a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
      b. "Foreign Products", as distinguished from "domestic products," are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens of nor living within the United States and its possessions.
   2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
   3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.3 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
   1. When specified products are available only from sources that do not or cannot produce a quantity adequate to complete project requirements in a timely manner, consult with the

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Architect for a determination of the most important product qualities before proceeding. Qualities may include attributes relating to visual appearance, strength, durability, or compatibility. When a determination has been made, select products from sources that produce products that possess these qualities, to the fullest extent possible.

B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.
   1. Each prime Contractor is responsible for providing products and construction methods that are compatible with products and construction methods of other prime or separate Contractors.
   2. If a dispute arises between prime Contractors over concurrently selectable, but incompatible products, the Architect will determine which products shall be retained and which are incompatible and must be replaced.

C. Foreign Product Limitations: Except under one or more of the following conditions, provide domestic products, not foreign products, for inclusion in the Work:
   1. No available domestic product complies with the Contract Documents.
   2. Domestic products that comply with Contract Document are only available at prices or terms that are substantially higher than foreign products that also comply with the Contract Documents.

D. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
   1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
   2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
   1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.

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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 the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
4. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
   1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
   2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
   1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
   2. Semiproprietary Specification Requirements: Where three (3) or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
      a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
   3. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

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4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.
    a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
6. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
7. Visual Matching: Where Specifications require matching an established Sample, the Architect's decision will be final on whether a proposed product matches satisfactorily.
    a. Where no product available within the specified category matches satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning "substitutions" for selection of a matching product in another product category, or for noncompliance with specified requirements.
8. Visual Selection: Where specified product requirements include the phrase "...as selected from manufacturer's standard colors, patterns, textures..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.

PART 3 EXECUTION

3.1 INSTALLATION OF PRODUCTS:

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.

B. Fiber, plastic, lead plugs and shields and any device using wood screws are not acceptable as fastening devices to plaster, tile, concrete or masonry. Use expansion bolts or driven devices in solid construction and toggle bolts in hollow construction.

C. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

3.2 PROTECTION

A. Each Prime Contractor shall be responsible for proper care and protection, and shall protect and be responsible for damage to his work or materials from the date of the Contract until final

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payment is made and shall make good, without cost to the Owner, all damage or loss that may occur during this period. All materials which may be affected by the weather shall be covered and protected to keep them free from damage while they are being transported to and stored on the site. Should any material be found defective or in any way contrary to the contract, this material, no matter in what stage of completion, may be rejected by the Architect and shall be removed from the premises at once.

END OF SECTION 01 60 00

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SECTION 01 70 00 - PROJECT CLOSEOUT

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operating and maintenance manual submittal.
   4. Submittal of warranties.
   5. Final cleaning.

B. Other administrative submittals required for project closeout (Final Payment) are enumerated in the Division 01 Section, Applications for Payment.

C. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 02 through 49.

1.2 SUBSTANTIAL COMPLETION

A. Each Prime Contractor is responsible for requesting and executing a Substantial Completion Inspection. Maximum coordination between the various Separate Prime Contractors is strongly encouraged for the execution of the execution of Substantial Completion Inspections.

B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
   2. Advise Owner of pending insurance change-over requirements.
   3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
   5. Submit record drawings, maintenance manuals, final damage or settlement survey, property survey, and similar final record information.
   6. Deliver tools, spare parts, extra stock, and similar items.

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7. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. The Architect will repeat inspection when requested and assured that the Work has been substantially completed.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

1.3 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.
1. Contractors Affidavit of Payments, Debts and Claims. AIA Document G706
2. Submit Contractor’s Affidavit of Release of liens AIA DocumentG706A
3. Submit consent of surety to final payment. AIA Document G707
4. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
5. Submit a certified copy of the Architect's final inspection list (punch list) of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
6. Submit Contractor's statement that his final application, as presented, is the final bill and no other claims will be presented.
7. Submit a final liquidated damages settlement statement.

B. Reinspection Procedure: The Architect will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.
1. Upon completion of reinspection, the Architect will prepare a certificate of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, reinspection will be repeated, but at the expense of the Contractor who will reimburse the Owner for these services by the Architect.

1.4 RECORD DOCUMENT SUBMITTALS

A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.

B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the

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installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.

D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.

E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.

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PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
   1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
      a. Remove labels that are not permanent labels.
      b. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition.
      c. Clean the site, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
   1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

3.2 WARRANTIES & GUARANTEES

A. In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.

B. The Contractor shall provide a written warranty covering all work performed by him for a period of one year.

END OF SECTION 01 70 00

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SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for cutting and patching.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

C. Demolition of selected portions of the building for alterations is included in Section "Selective Demolition."

1.2 SUBMITTALS

A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
   1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
   2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
   3. List products to be used and firms or entities that will perform Work.
   4. Indicate dates when cutting and patching is to be performed.
   5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
   6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
   7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.3 QUALITY ASSURANCE

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
   1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
      a. Bearing and retaining walls.
      b. Structural concrete.
      c. Structural steel.

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d. Lintels.
e. Timber and primary wood framing.
f. Structural decking.
g. Stair systems.
h. Miscellaneous structural metals.
i. Equipment supports.
j. Piping, ductwork, vessels and equipment.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
a. Primary operational systems and equipment.
b. Air or smoke barriers.
c. Water, moisture, or vapor barriers.
d. Membranes and flashings.
e. Fire protection systems.
f. Noise and vibration control elements and systems.
g. Control systems.
h. Communication systems.
i. Electrical wiring systems.

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

PART 2 PRODUCTS

2.1 MATERIALS

A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.1 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

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1. Before proceeding, meet at the 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.

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 the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE

A. General: A Contractor, subcontractor or sub-subcontractor requiring changes in existing work, and work in place, shall have such changes performed by the trades skilled in performing the particular work and such changes shall be at the expense of the Contractor, subcontractor or sub-subcontractor requiring the change. Review changes with the Architect prior to proceeding with the work and include installation of such reinforcement of the work as the Architect may direct.

B. Employ skilled workmen 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 activities and the subsequent fitting and patching required to restore surfaces to their original condition.

C. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

D. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

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2. 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. Firestopping and draftstopping.
    a. Where fire rated and/or smoke barrier construction (walls, floors or ceilings) are penetrated, all penetrations shall be fire-safed and sealed using appropriate fire rated materials and approved methods.
    b. Where non-fire rated construction (walls, floors or ceilings) are penetrated, the penetration shall be sealed tight with approved draftstopping materials.

3.4 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION 01 73 29

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SECTION 02 41 00 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

C. Abandonment and removal of existing utilities and utility structures.

1.2 RELATED REQUIREMENTS

A. Section 01 11 01 Summary of Work

B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.3 DEFINITIONS

A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2027.

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1.5 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.
   1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
   2. Demolition firm qualifications.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 DEMOLITION

A. Remove portions of existing buildings as indicated on Drawings.

B. Remove paving and curbs required to accomplish new work.

C. Remove all other paving and curbs within site boundaries.

D. Within area of new construction, remove foundation walls and footings to minimum 2 feet below finished grade.

E. Remove other items indicated, for salvage, relocation, and recycling.

F. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill .

3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.

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4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
5. Provide, erect, and maintain temporary barriers and security devices.
6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
8. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
9. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Protect existing structures and other elements to remain in place and not removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

E. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

F. Hazardous Materials:
1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.
2. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.

G. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Dismantle existing construction and separate materials.
2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

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B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone. Identify and mark, in same manner as other utilities to remain, utilities to be reconnected.

3.4 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from areas that remain occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of constructiion as indicated in Section 01 50 00.

C. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

D. Remove existing work as indicated and required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction indicated.
   2. Remove items indicated on drawings.

E. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.

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2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
1. Prevent movement of structure. Provide shoring and bracing as required.
2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch to match new work.

3.5 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.
1. Contractor is responsible for testing of material as required by their chosen disposal facility and for all disposal costs required for demolition.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 03 01 00 - MAINTENANCE OF CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleaning of existing concrete surfaces.

B. Repair of exposed structural, shrinkage, and settlement cracks.

C. Scope of Work: As indicated on drawings.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete:

1.3 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2026.

B. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.

C. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2022.

D. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2024.

E. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals, for submittal procedures.

B. Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Manufacturer's instructions.

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D. Manufacturer's qualification statement.

E. Cleaner's qualification statement.

F. Installer's qualification statement.

G. Project Record Documents: Accurately record actual locations of structural reinforcement repairs and type of repair.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Cleaner Qualifications: Company specializing in, and with minimum of 3 years of experience in, the type of cleaning specified.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum of 3 years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturers' instructions for storage, shelf life limitations, and handling of products.

B. Deliver polymer resin materials in original factory-sealed containers with manufacturer's labels intact and legible. Verify product nomenclature, manufacturer's name, product identification, batch number, date of manufacture, and shelf life or expiration date. Do not use polymer resin materials that have exceeded shelf life.

C. Store materials in covered, well-ventilated area and according to manufacturer's written storage instructions. Store polymer resins and hardeners separate from construction materials that can absorb odors.

PART 2 PRODUCTS

2.1 CLEANING MATERIALS

A. Degreaser:
1. Manufacturers:
a. Euclid Chemical Company
b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc:
c. W. R. Meadows, Inc:
d. Approved equal.

B. Detergent: Non-ionic detergent.

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C. Strippers and Cleaners for Removal of Existing Coatings:
   1. Manufacturers:
      a. Nox-Crete, Inc; Deco-Strip Series: www.nox-crete.com/#sle.
      b. Approved equal.

2.2 CEMENTITIOUS PATCHING AND REPAIR MATERIALS

A. Manufacturers:
   1. Approved equal.

B. Cementitious Repair Mortar, Trowel Grade: One- or two-component, factory-mixed, polymer-modified cementitious mortar.
   1. In-place material resistant to freeze/thaw conditions.
   2. Mixed with water or latex type bonding agent in proportions as recommended by manufacturer.
   3. Integral corrosion inhibitor.
   4. Manufacturers:
      a. ARDEX Engineered Cements; ARDEX Feather Finish
      b. Euclid Chemical Company; EXPRESS REPAIR
      c. Approved equal.

2.3 EPOXY INJECTION MATERIALS

A. Ultra-Low Viscosity, Epoxy Injection Resin: Two component, low viscosity, high modulus, pre-proportioned, moisture insensitive, VOC compliant, 100 percent solids epoxy adhesive. Product must conform to ASTM C 881 Type IV, Grade 1, Class C. Material must have the following properties at 73 degrees F.:
   1. Compressive Yield in accordance with ASTM DD695 Minimum 11,000 psi (75.8 MPa) @ 7 days.
   2. Slant Shear Bond Strength in accordance with ASTM C882 Minimum 2,100 psi (15.5 MPa) @ 14 days.
   3. Mixed Viscosity of 80 to 120 cp
   4. Gel Time 70 to 90 minute in accordance with ASTM C881
   5. Manufacturer:
      a. Euclid Chemical Company, Dural 335 Basis of Design
      b. Approved Equal

2.4 ACCESSORIES

A. Anchoring Adhesive: Self-leveling or non-sag as applicable.
   1. Self-Leveling Epoxy Products:
      a. Euclid Chemical Company; DURAL FAST SET LV
      b. Approved equal.
   2. Non-Sag Epoxy Products:
      a. Euclid Chemical Company; DURAL FAST SET GEL
      b. Approved equal.

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B. Portland Cement: ASTM C150/C150M, Type I, grey.

C. Sand: ASTM C33/C33M or ASTM C404; uniformly graded, clean.

D. Water: Clean and potable.

E. Reinforcing Steel: ASTM A615/A615M Grade 40 (40,000 psi) billet-steel deformed bars, unfinished.

F. Reinforcing Steel: Deformed bars, ASTM A996/A996M Grade 40 (280), Type A.
1. Galvanized in accordance with ASTM A767/A767M, Class I.
2. Epoxy coated in accordance with ASTM A775/A775M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means acceptance of substrate.

3.2 CLEANING EXISTING CONCRETE

A. Provide enclosures, barricades, and other temporary construction as required to protect adjacent work from damage.

B. Clean concrete surfaces of dirt or other contamination using the gentlest method that is effective.
1. Try the gentlest method first, then, if not clean enough, use a less gentle method taking care to watch for impending damage.
2. Clean out cracks and voids using same methods.

C. The following are acceptable cleaning methods, in order from gentlest to less gentle:
1. Water washing using low-pressure, maximum of 100 psi, and, if necessary, brushes with natural or synthetic bristles.
2. Increasing the water washing pressure to maximum of 400 psi.
3. Adding detergent to washing water; with final water rinse to remove residual detergent.
4. Steam-generated low-pressure hot-water washing.

D. Do not use any of the following cleaning methods, unless otherwise indicated:
1. Brushes with wire bristles, grinding with abrasives, solvents, hydrochloric or muriatic acid, sodium hydroxide, caustic soda, or lye.
2. Soap or detergent that is not non-ionic.

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3.3 CRACK REPAIR USING EPOXY ADHESIVE INJECTION

A. Repair exposed cracks.

B. Follow epoxy adhesive manufacturer's written installation instructions.

C. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than the depth of the crack to be filled or port size diameter no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.

D. Inject adhesive into ports under pressure using equipment appropriate for particular application.

E. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.

F. Remove temporary seal and excess adhesive.

G. Clean surfaces adjacent to repair and blend finish.

3.4 CONCRETE SURFACE REPAIR USING CEMENTITIOUS MATERIALS

A. Clean concrete surfaces, cracks, and joints of dirt, laitance, corrosion, and other contamination using method(s) specified above and allow to dry.

B. Follow bonding agent and repair mortar manufacturer's written installation instructions.

C. Apply coating of bonding agent to entire concrete surface to be repaired.

D. Fill voids with cementitious mortar flush with surface.

E. Apply repair mortar by steel trowel to a minimum thickness of 1/4 inch over entire surface, terminating at a vertical change in plane on all sides.

F. Trowel finish to match adjacent concrete surfaces.

G. Damp cure for four days.

END OF SECTION

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SECTION 03 05 16 - UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.2 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2024.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.3 SUBMITTALS

A. Product Data: Submit manufacturers' data on manufactured products.

B. Test Data: Submit report of tests showing compliance with specified requirements.

C. Samples: Submit samples of underslab vapor barrier to be used.

D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Underslab Vapor Barrier: Extruded polyolefin.
   1. Water Vapor Permeance: Not more than 0.020 perms, maximum.
   2. Complying with ASTM E1745 Class A., and ACI 302.2R.
   3. Thickness: 15 mils.
   4. Manufactuers:
      a. Henry Company; Fortifiber Building Systems Group, Moistop Ultra 15
      b. ISA Building Products; Viper Vaporcheck II
      c. Raven Industries VaporBlock Series VB15
      d. Reef Industries, Inc; Griffolyn 15 Mil
      e. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil)
      f. W.R. Meadows; Perminator 15 Mil
      g. Approved equal.

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B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Suspended slabs.
5. Equipment pads and curbs.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

F. Samples: For water-stops, vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Welding Certificates

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Waterstops.
7. Curing compounds.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semi-rigid joint filler.
12. Joint-filler strips.
13. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Field quality-control reports.

F. Minutes of pre-installation conference

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II
3. Certification of recycled content shall be in accordance with the Sustainable Building Submittal Requirements of this section.
4. Adhesives or sealants used for work in this section shall meet the VOC requirements of this section, where applicable.
5. Recycled Steel: Reinforcing bar, steel wire, welded wire fabric, and miscellaneous steel accessories shall contain a minimum of 35% (combined) pre-consumer/post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials).

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 7, “Lightweight Concrete.”
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Pre-installation Conference: Conduct conference at Project site or another pre-approved location.

1. Review the proposed concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor / finishing foreman.
e. Special concrete finish subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semi-rigid joint fillers, forms and form removal limitations, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.8 MEASUREMENTS

A. Field Measurements: Obtain all field measurements required for proper fabrication and installation of work. Submit prior to installation, all measurements indicating discrepancies from the drawings. Describe in writing, and where applicable, by sketches proposed methods of correcting the discrepancies. Measurements are the responsibility of the contractor.

B. Lay out each part of the work in strict accordance with the architectural, structural, mechanical, electrical, plumbing and all other drawings and be responsible for correct location of the same. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.

C. Templates:Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable, or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

3. Furnish ties with integral water-barrier plates to walls indicated to receive damp-proofing or waterproofing.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 35 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

C. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

D. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.

E. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

F. Deformed-Steel Wire: ASTM A 496/A 496M.

G. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

H. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II, gray. Supplement with the following:

    a. Fly Ash: ASTM C 618, Class F or C
    b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4-inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Lightweight Aggregate: ASTM C 330, 3/4-inch (19mm) nominal maximum aggregate size.

E. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260. Subject to compliance with requirements, provide one of the following:

1. Air Mix 200 or AEA 92S; Euclid Chemical Company
2. Darex AEA; W.R. Grace
3. MasterAir VR 10; BASF
4. Other approved equal

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A. Provide one of the following:

    a. Eucon WR-91; Euclid Chemical Company
    b. MasterPolyheed 997; BASF
    c. WRDA 64; W.R. Grace
    d. Other approved equal

2. Retarding Admixture: ASTM C 494/C 494M, Type B.

3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D. Provide one of the following:

a. Eucon Retarder 75; Euclid Chemical Company
b. MasterSet R 100; BASF
c. Daratard; W.R. Grace
d. Plastiment; Sika Corp.
e. Other approved equal

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F. Provide one of the following:

a. Eucon 37, Plastol Series or SPC; Euclid Chemical Company
b. MasterRheobuild 1000 or MasterGlenium 7500; BASF
c. Daracem-100; W.R. Grace
d. Other approved equal

5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G. Provide one of the following:

a. MasterGlenium Series; BASF
b. Eucon 537; Euclid Chemical Company
c. ViscoCrete Series; Sika Corp.
d. Other approved equal

2.6 FIBER REINFORCEMENT

A. Synthetic Micro-Fiber: Monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches (13 to 38 mm) long.

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. Monofilament Micro-Fibers:

1) Axim Italcementi Group, Inc.; Fibrasol II P.
2) Euclid Chemical Company (The); Fiberstrand 100.
3) Grace Construction Products, W. R. Grace & Co.; Grace MicroFiber.
4) Sika Corporation; Sika Fiber PPM.
5) Other approved equal

b. Fibrillated Micro-Fibers:

1) Axim Italcementi Group, Inc.; Fibrasol F.
2) Euclid Chemical Company (The); Fiberstrand F.
3) Grace Construction Products, W. R. Grace & Co.; Grace Fibers.
4) Sika Corporation; Sika Fiber PPF.

5) Other approved equal

B. Synthetic Macro-Fiber: Synthetic (Polyolefin) Macro fibers shall be a coarse monofilament, self-fibrillating, polypropylene/polyethylene to blend in accordance with ASTM C1116, Paragraph 4.1.3, Type III and ASTM D7508. Synthetic macro-fiber shall be a minimum 1-1/2-inch (38mm) length, a minimum aspect ratio of 50-90, and shall provide a minimum tensile strength of 70 KSI (483 MPa). Synthetic macro-fiber shall be UL-certified for 2-hour minimum fire-resistance-rated construction when used in lieu of welded wire fabric in UL Design Series D700, D800, and D900 Floor-Ceiling Assemblies.

1. Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 4.0 lb/cu. yd. (2.4 kg/cu. m) for suspended slabs over metal decks in accordance with Steel Deck Institute Manual 31.
2. Submit fiber manufacturer's documentation indicating that proposed fiber dosage will provide a minimum Re3 (R^{D}_{T150}) value of <insert value> percent in accordance with ASTM C 1609.
3. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 3.0 lb/cu. yd. (1.78 kg/cu. m) for concrete slabs on ground.

    a. Tuf-Strand SF; Euclid Chemical Company
    b. Strux 90/40; GCP Applied Technologies
    c. Other approved equal

2.7 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. BoMetals, Inc.
    b. Greenstreak.
    c. Paul Murphy Plastics Company.
    d. Vinylex Corp.
    e. Other approved equal

2. Profile: Ribbed with center bulb
3. Dimensions: 4 inches by 3/16 inch thick (100 mm by 4.75 mm thick) nontapered.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

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. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
b. CETCO; Volclay Waterstop-RX.
c. Concrete Sealants Inc.; Conseal CS-231.
d. Greenstreak; Swellstop.
e. Other approved equal

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

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. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
b. Meadows, W. R., Inc.; Perminator 15 mil.
c. Raven Industries Inc.; Vapor Block 15.
d. Reef Industries, Inc.; Griffolyn Type-65G.
e. Other approved equal

2.9 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid/Sealer Densifier (VOC Compliant): Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces. The compound must contain a minimum solids content of 20%, of which 50% is siliconate.

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. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
b. L&M Construction Chemicals, Inc.; Seal Hard.
c. Meadows, W. R., Inc.; LIQUI-HARD.
d. Other approved equal

2. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for sealants applied at Project site, the following VOC limits,

exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

a. Primers, Sealers, and Undercoaters: 200 g/L.
b. Waterproofing Concrete/Masonry Sealers: 400 g/L.
c. Concrete-Curing Compounds: 100 g/L.
d. Floor Coatings: 100 g/L.
e. Other approved equal

2.10 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound (VOC Compliant): ASTM C 309, Type 1, Class B, dissipating.

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. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
b. BASF Construction Chemicals - Building Systems; Kure 200.
c. Euclid Chemical Company (The); Kurez DR-100 OR Everclear VOX.
d. L&M Construction Chemicals, Inc.; L&M Cure R.
e. Meadows, W. R., Inc.; 1100-CLEAR.
f. Other approved equal

2. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for sealants applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

a. Primers, Sealers, and Undercoaters: 200 g/L.
b. Waterproofing Concrete/Masonry Sealers: 400 g/L.
c. Concrete-Curing Compounds: 100 g/L.
d. Floor Coatings: 100 g/L.
e. Other approved equal

3. Provide one of the following:

a. Dural 452 Series; The Euclid Chemical Company

b. Sikadur 32 Hi-Mod Series; Sika Corp.
c. Other approved equal

2.11 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Epoxy Bonding Adhesive (VOC Compliant): ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
2. VOC Content: Epoxy Bonding Adhesive shall have a VOC content of 70 g/L or less.

C. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

D. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.12 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8-inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4,100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
5. Products: Subject to compliance with requirements, provide one of the following or equal approved by Engineer of Record:

a. Flo-Top, Super Flo-Top or EucoFloor SL160; Euclid Chemical Company
b. MasterTop 111 SL; BASF
c. Other approved equal

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4-inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8- to 1/4-inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 4,000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.
5. Products: Subject to compliance with requirements, provide one of the following (or equal) approved by the Engineer of Record:

    a. Thin Top Supreme, Tammspatch II or Concrete Top Supreme; Euclid Chemical Company
    b. Sikatop 121 or Sikatop 122; Sika Corp.
    c. Other approved equal

2.13 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.

1. Limit percentage, by weight of cementitious materials other that Portland cement in concrete as follows for F3 exposure concrete elements:

    a. Fly Ash: 25-percent.
    b. Slag Cement: 50-percent.
    c. Combined Fly Ash or Pozzolan and Slag Cement: 50-percent Portland cement minimum, with fly ash or pozzolan not exceeding 25-percent.
    d. Silica Fume/metakaolin: 10-percent.
    e. Combined Fly Ash, Pozzolans, and Silica Fume/metakaolin: 35-percent with fly ash or pozzolans not exceeding 25-percent and Silica Fume/metakaolin not exceeding 10-percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use high water-reducing admixture in pumped concrete, architectural concrete for heavy-use industrial slabs and parking structure slabs, self-consolidating concrete, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use a non-corrosive accelerator in all concrete less than 8 inches in thickness, placed at temperatures below 50 degrees Fahrenheit. Do not use calcium chloride, salts or other admixtures containing more than 0.5% chloride ions by weight.
5. Use corrosion inhibiting admixture in concrete mixtures where indicated. The dosage shall be 3-5 gallons/cy unless otherwise noted on the plans.

2.14 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings, Foundation Walls, and Piers: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,000 psi (27.6 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 9-inches (225 mm) for concrete with verified water-slump of 2- to 3-inches (50 to 75 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1-inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,000 psi (27.6 MPa) at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd. (320 kg/cu. m).
4. Slump Limit: Recommended 6-inches (150 mm).
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer’s recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m)

C. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 4,000 psi (27.6 MPa) at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: Recommended 4-inches (150 mm), plus or minus 1-inch (25mm).
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
5. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m)

2.15 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.16 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Do not chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not

less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 80 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

3.5 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Locate vertical joints in walls beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

3.8 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
2. The Concrete Producer shall provide a re-dosage chart for the high range water reducing admixture. Re-dosage onsite may be required to keep the concrete in the approved slump or spread envelope.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6-inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
4. Freeze resistant concrete may be used with prior approval of the Engineer of Record.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete or as indicated.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

E. Architectural Concrete Finish: Provide smooth, uniform finish upon form removal with no patching, stoning or other form of repair, except washing, permitted unless otherwise noted for walls, columns, and other surfaces visible to view when the work is complete. Use self-consolidating concrete. The surface shall match the approved jobsite mockup panel.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch (6 mm) in one direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated or to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

    a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-grade.
    b. Specified overall values of flatness, F(F) 30; with minimum local values of flatness, F(F) 24; for suspended slabs.

3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 3/16 inch (4.8 mm).

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a strippable or dissipating curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Interior slabs to receive resilient flooring: Cure only with moisture retaining cover. Strippable or dissipating curing compounds may be used on trowel finished surfaces.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 14 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess

material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least 6 month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one-part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling, and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture

and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173 M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Water Content and W/cm: In accordance with AASHTO T318 (Microwave Test).
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day’s pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.

a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three-consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Monthly charts of compressive strength, w/cm and air content will be sent to all parties on the pre-concrete conference distribution list.
12. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
13. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
14. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
15. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
16. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 48 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 03 30 00

SECTION 04 01 00 - MAINTENANCE OF MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cleaning of new and existing masonry surfaces.

B. Repointing mortar joints.

C. Resealing of mortar joints.

D. Repair of flashing.

1.2 REFERENCE STANDARDS

A. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.

B. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.

C. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.3 SUBMITTALS

A. Product Data: Provide data on cleaning compounds.

B. Verification Samples: Submit 4 inch strip of mortar to illustrate color and texture.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry neatly stacked and tied on pallets. Store clear of ground with adequate waterproof covering.

1.5 FIELD CONDITIONS - MASONRY WORK

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Restoration and Cleaning Chemicals:

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1. Diedrich Technologies, Inc: www.diedrichtechnologies.com.
2. PROSOCO: www.prosoco.com.
3. Approved equal.

2.2 CLEANING MATERIALS

A. Cleaning Agent: Environmentally safe detergent that will not harm vegetation below.

2.3 MORTAR MATERIALS

A. Provide mortar matching existing mortar:
   1. Match color, texture and tooling, and sand.
   2. Provide greater vapor permeability and be softer (measured in compressive strength) than the masonry units.
   3. Match or exceed vapor permeability and softness (measured in compressive strength) of the historic mortar.

B. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

C. At Contractor's option, mortar and grout may be made from factory premixed dry materials with addition of water only.

D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

2.4 MASONRY MATERIALS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Match existing.
   2. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block.
      b. Exposed Faces: Manufacturer's standard color and texture where indicated.
      c. Exposed Faces: Special color and texture where indicated, as follows: _____.
      d. Pattern: Vertical single score.
      e. Pattern: Vertically ribbed and split.
   3. Nonloadbearing Units: ASTM C129.
      a. Hollow block.
      b. Normal weight.
   4. Decorative-Faced Units: ASTM C90 hollow block.
      a. Pattern: Match existing.

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2.5 FLASHINGS

A. Metal Flashing Materials:
1. To match existing.
1) Approved equal.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces to be cleaned are ready for work of this section.

3.2 PREPARATION

A. Protect surrounding elements from damage due to restoration procedures.

B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas using means adequate to prevent damage.

D. Cover existing landscaping with tarpaulins or similar covers.

E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

F. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

G. Do not allow cleaning runoff to drain into sanitary or storm sewers.

3.3 REBUILDING

A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.

B. Support structure as necessary in advance of cutting out units.

C. Cut away loose or unsound adjoining masonry as directed by Construction Manager.

D. Build in new units following procedures for new work specified in other section(s).

E. Mortar Mix: Colored and proportioned to match existing work.

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F. Ensure that anchors are correctly located and built in.

G. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

3.4 REPOINTING

A. Perform repointing prior to cleaning masonry surfaces.

B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch depth or until sound mortar is reached.

C. Use power tools only after test cuts determine no damage to masonry units will result.

D. Do not damage masonry units.

E. When cutting is complete, remove dust and loose material by brushing.

F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch layers. Form a smooth, compact concave joint to match existing.

G. Moist cure for 72 hours.

H. Allow mortar to fully cure 28 days before final cleaning.

3.5 RESEALING

A. General: Comply with Section 07 92 00 - Joint Sealants.

B. Rake out old sealant or mortar from joints by hand using a hammer and chisel. Rake to expose sound mortar.

C. Remove loose dirt and debris from the joint using a stiff bristle brush or vacuum.

D. Prime joint surfaces as recommended by the sealant manufacturer. Protect adjacent surfaces from spillage or spattering of sealant.

E. Insert backing rod to a depth equal to 1/2 the width of the joint.

F. Fill joint with sealant. Tool joint within 10 minutes of placing. Finish joint level with the stone surface.

G. Remove excess sealant from the stone surface immediately.

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3.6 CLEANING EXISTING MASONRY

A. High Pressure Cold Water: (Exterior Only) Cold water blast with pressure as needed to remove dirt and discoloration while preserrving integrity of masonry surfaces, at all locations, providing uniform finish.

B. Brush Clean with detergent per manufacturers instructions, any areas not fully cleaned by pressure washing on the exterior, or where cleaning is required on the interior.

3.7 CLEANING NEW MASONRY

A. Verify mortar is fully set and cured.

B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.

C. Scrub walls with cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.

D. Use acid solution mixed with water in accordance with manufacturer's instructions. Apply acid solution and scrub masonry with stiff fiber brushes. Do not scrub the mortar joints.

E. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

F. Before solution dries, rinse and remove acid solution and dissolved mortar, using clean, pressurized water.

3.8 CLEANING

A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.

B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.

END OF SECTION

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SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Flashings.

E. Lintels.

F. Accessories.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).

C. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2026.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.

F. ASTM C90 - Standard Specification for Dry-Cast Loadbearing Concrete Masonry Units; 2024a.

G. ASTM C129 - Standard Specification for Dry-Cast Nonloadbearing Concrete Masonry Units; 2025.

H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2025.

I. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.

J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2024.

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K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025b.

L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.

M. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

N. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2024.

O. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2025.

P. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.

Q. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

R. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

S. UL (FRD) - Fire Resistance Directory; Current Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.

D. Samples: Submit four samples of decorative block units to illustrate color, texture, and extremes of color range.

E. Verification Samples: Submit 4 inch strip of mortar to illustrate color and texture.

F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

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1.5 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Fire Rated Assemblies: Comply with applicable code for UL (FRD) Assembly No. U905.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum ten years of experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years of documented experience.

1.6 MOCK-UPS

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.

B. Include mortar, accessories, structural backup, wall openings, flashings (with lap joint, corner, and end dam), and wall insulation in mock-up.

C. Do not proceed with work until mock-up has been approved.

D. Locate where directed.

E. Mock-up may remain as part of work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide nonstandard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
      a. Provide bullnose units for outside corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block.
   4. Nonloadbearing Units: ASTM C129.
      a. Hollow block.

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b. Normal weight.

5. Decorative-Faced Units: ASTM C90 hollow block.
   a. Exposed Faces: Split
   b. Size: As indicated on Drawings
   c. Color: To match existing and as approved by Architect and Owner
   d. Pattern: To match exisitng and as approved by Architect and Owner.
   e. Manufacturers:
      1) York Building Products.
      2) E.P. Henry.
      3) Approved equal.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
   1. Color(s): As selected by Architect from manufacturer's full range.

F. Water: Clean and potable.

G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Color: Mineral pigments added as required to produce approved color sample.

H. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

2.3 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited
   2. Hohmann & Barnard, Inc.
   3. TruFast Walls, a division of Altenloh, Brinck & Co. US, Inc.
   4. Approved Equal
   5. Approved equal.

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B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
1. Type: Truss or ladder.
2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

E. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

F. Masonry Veneer Anchors: Thermally broken 2-piece wing nut anchors with insulation retention washers that permit differential movement between masonry veneer and structural backup, stainless steel.
1. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
2. Vertical adjustment: Not less than 1.25 inches.
3. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch diameter.
4. Manufacturers:
   a. Heckman; Pos-I-Tie with ThermalClip
   b. Hohman & Barnard, Inc; 2-Seal Thermal Wingnut
   c. Senneco
   d. Approved Equal

2.4 FLASHINGS

A. Metal Flashing Materials:
1. Stainless Steel Flashing: ASTM A666/A666M, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.

B. Shop- or Factory-Fabricated Flashing Corners and End Dams: Stainless steel.

C. Termination Bars: Aluminumn; compatible with membrane and adhesives.
1. Size: 1 inch by 0.125 inch, punched 6 inches on center for fasteners.

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D. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.

2.5 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers:
      a. Blok-Lok Limited
      b. Hohmann & Barnard, Inc.
      c. WIRE-BOND
      d. Approved Equal

B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Advanced Building Products Inc.
         2) Hohmann & Barnard, Inc.
         3) Mortar Net Solutions
         4) Approved Equal

C. Weeps:
   1. Type: Polyester mesh.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. CavClear/Archovations, Inc.
      b. Mortar Net Solutions
      c. Hohmann & Barnard, Inc.
      d. Approved Equal

D. Cavity Vents:
   1. Type: Polyester mesh.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. CavClear/Archovations, Inc.
      b. Hohmann & Barnard, Inc:
      c. Mortar Net Solutions
      d. Approved Equal

E. Drainage Fabric: Polyester or polypropylene mesh.
   1. Manufacturers:
      a. Advanced Building Products, Inc.
      b. Archovations, Inc; CavClear Masonry Mat
      c. Mortar Net Solutions

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d. York Manufacturing, Inc.
e. Approved Equal

F. Multicomponent Cavity Wall Drainage System: Combination mortar diverter, flashing and weep system.
1. May be used in lieu of flashing, cavity mortar control, and weeps described above.
2. Membrane Type: Stainless steel.
3. Drip Edge: Stainless steel.
4. Termination Bar: Stainless steel.
5. Manufacturers:
a. Mortar Net Solutions
b. York Manufacturing, Inc; Flash-Vent
c. Illinois Products Corporation
d. Approved Equal

2.6 LINTELS

A. Prefabricated Steel Lintels:
1. Manufacturers:
a. Hohmann & Barnard, Inc; Engineered Concealed Lintel Systems:
b. Approved equal.

2.7 MORTAR AND GROUT MIXING

A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
1. Exception at colored mortar: Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.

B. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
1. Masonry below grade and in contact with earth: Type S.
2. Exterior, non-loadbearing masonry: Type N.
3. Interior, loadbearing masonry: Type N.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

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B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

D. Verify that weather barrier has been installed over substrate completely and correctly, and that testing has been completed.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
1. Bond: Running.
2. Mortar Joints: Concave

D. Decorative Faced
1. Bond: Running and Stacked, as indicated on Drawings.
2. Mortar Joints: Concave.

END OF SECTION

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Structural Steel.
2. Bolts and/or Welding.
3. Field Installed Shear Connectors.
4. Grout.

B. Related Requirements:

1. Division 05 Section 055100 “Metal Stairs” and Section 055213 “Pipe and Tube Railings” for steel stair and associated railing fabrication.
2. Division 09 Section 099100 "Painting" for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 PRE-INSTALLATION MEETINGS

A. Pre-Installation Conference: Conduct conference at Project Site.

1.5 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections and moment connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering design by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using general notes provided on the plans and AISC 360.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pre-tensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
6. Prepare shop drawings in conformance with the best standards of the construction industry, and not less complete than indicated by the applicable procedures shown in “Structural Steel Detailing,” latest edition, published by AISC. Prepare shop drawings under the supervision of competent engineering personnel, licensed by the state in which the construction is to take place. During the preparation of shop drawings, and prior to submittal, coordinate and cross check all shop drawings, including those prepared by subcontractors, for compliance with the Contract Documents. Each shop drawing shall bear the signature of the engineer in charge of structural steelwork for the steelwork subcontractor, and the initials of the individual actually preparing the drawing.
7. Show clearly all work, including relationship of structural steel to the adjacent work of other trades and to significant lines of finishes of other trades.
8. Do not fabricate or deliver work to the site before drawings reviewed by the architect have been returned.
9. Show explicitly the type of connection used in each location, the grade, size and number of bolts; the type, number, position, designation and orientation of each hole; and the size of each hole, whether slotted or round. Ensure that adequate wrench clearance for correct bolt tightening is provided and note special bolt tightening sequences where necessary.
10. Prepare original shop drawings. The used of the engineer’s or architect’s drawings as a base for photographic or other reproduction for shop drawings as a base for photographic or other reproduction for shop drawings or details will not be

permitted. Show clearly the size and location of each member and the erection mark assigned to each member. Show each field connection with all data and details necessary for assembling the structure. Direct special attention to the possible need for special guying, bracing, or shoring to prevent deformation of existing or new structure due to stresses caused by erection procedures and equipment, by construction loadings, and by forces of natural phenomena.

11. Prepare, keep up-to-date, and submit a complete drawing index cross-referencing each assigned piece mark with the drawing number in which the piece is detailed. Detail drawings submitted without an up-to-date index and the applicable erection drawing(s) showing the location of each piece will be deemed an incomplete submission and will not be accepted as subject to an agreed shop drawing review schedule.
12. Prepare anchor bolt and baseplate erection drawings containing complete location and placing details, including details of all templates. Provide anchor bolt erection drawings to the concrete trade in advance of applicable concrete work and in coordination with concrete construction sequence.
13. Direct the architect's attention in writing to any proposed deviations from the Contract Documents, prior to the submission of shop drawings showing the proposed deviation. Submit requests for deviations on the steelwork subcontractor's letterhead. Deviations not identified, or identified only in letters of transmittal or in shop drawings or both, without the required written request, may not be accepted, and shall be sufficient cause for the architect to return each shop drawings containing such deviations without further action. Acceptance of shop drawing containing deviations not detected by the architect during shop drawing review shall not relieve the steelwork subcontractor from responsibility to conform strictly to the Contract Documents.
14. Prior to resubmission of shop drawings with additions or corrections, circle and identify all changes. Drawings submitted without each change being clearly identified are subject to return for resubmission.
15. Prior to making shop drawings for any portion of the work involving alterations to an existing structure, make all necessary field observations, measurements, and surveys of existing conditions. If probes are required to accomplish such measurements, give timely notice where probes will be required.

C. Qualification Data: For qualified Installer, fabricator, professional engineer, and testing agency.

D. Welding certificates.

E. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

F. Mill test reports for structural steel, including chemical and physical properties.

G. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength bolt-nut-washer assemblies.
4. Shear stud connectors.
5. Shop primers.
6. Non-shrink grout.

H. Source quality-control reports.

I. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer, who to the satisfaction of the Architect and Owner, has successfully completed similar projects in size and complexity to the proposed project, and who can provide suitable documentation to confirm this experience and capabilities. Said documentation shall be data for recent project experience including, but not limited to; owner name and contact information, location, name and contact information for general contractor, gross area of building, use of building, contract amount, and any other information that is deemed appropriate to communicate that the installer is appropriately qualified. Installer shall also provide a copy of their detailed written quality assurance plan/program. Qualified installer shall either participate in the AISC Quality Certification Program and be designated an AISC-Certified Erector, Category CSE - or - provide a similar quality program acceptable to the Architect.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 360.
3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Pre-installation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and re-lubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.10 MEASUREMENTS

A. Field-Measurements: Provide as-built survey of anchor rods/bolts after installation. Make necessary minor adjustments to accommodate misplacement.

B. Lay out each part of the work in strict accordance with the architectural and structural drawings with regards to framing and slab edges. See architectural edge of slab/control point drawings for slab edge extents. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.

C. Templates:Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than the following:

1. W-Shapes: 35 percent.
2. Channels, Angles, M, S-Shapes: 35 percent.
3. Plate and Bar: 25 percent.
4. Cold-Formed Hollow Structural Sections: 35 percent.
5. Steel Pipe: 25 percent.
6. All Other Steel Materials: 25 percent.

B. W-Shapes: ASTM A 992/A 992M.

C. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

D. Plate and Bar: ASTM A 36/A 36M.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: As indicated.
2. Finish: Black except where indicated to be galvanized.

G. Steel Castings: ASTM A 216/A 216M, Grade WCB with supplementary requirement S11.

H. Steel Forgings: ASTM A 668/A 668M.

I. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 or ASTM A490; Cold forged with rolled threads. Do not use A325 and A490 bolts of the same diameter. Different grade bolts must vary in diameter by a minimum of 1/4-inch.

1. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M,

Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.

1. Finish: Hot-dip zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating, baked epoxy-coated finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight or Hooked.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Plain except where indicated to be hot-dip zinc coating, ASTM A 153/A 153M, Class C.

F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
4. Finish: Plain.

G. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
3. Finish: Plain except where indicated to be hot-dip zinc coating, ASTM A 153/A 153M, Class C

2.3 PRIMER

A. Primer for Steel to Receive High-Performance Coating: Primer shall be as specified in Division 9 Sections “Painting” and “High-Performance Coatings.”

1. Coordinate with the architectural drawings and finish schedule for steel framing exposed to public view and requiring a painted finish.

B. Primer for Other Steel: Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: ASTM A 780.

D. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction [and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].

1. Flat Paints and Coatings: 50 g/L.
2. Non-flat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

2.4 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened typical; Slip critical where indicated.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP APPLIED COATINGS

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2-inches.
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.

4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.

B. Surface Preparation for Steel: Clean steel surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5-mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, non-asphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels, shelf angles and members which are permanently exposed to weather.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

F. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when

permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened typical; slip-critical where indicated.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.

1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.

2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 05 12 00

SECTION 05 31 00 – STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof Deck.
2. Composite Floor Deck.

B. Related Requirements:

1. Division 03 Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
2. Division 05 Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATION SUBMITTALS

A. Product Certificates: For each type of steel deck, signed by product manufacturer.

B. Welding certificates.

C. Field quality-control test and inspection reports.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

E. Research/Evaluation Reports: For steel deck.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

F. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1.7 MEASUREMENTS

A. Lay out each part of the work in strict accordance with the architectural and structural drawings with regards to framing and slab edges. See architectural edge of slab/control

point drawings for slab edge extents. Lay out from at least two pre-established benchmarks and axis lines, individually correct for length and bearing.

B. Templates: Furnish templates and layout drawings for exact locations of items to be embedded in concrete, with setting instructions required for installation of embedded items.

C. Coordination: Steel deck shop drawings shall be coordinated as with the supporting structural steel shop drawings; this included dimensions and measurements indicated on those shop drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 35 percent.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam United States; Canam Group Inc.
2. Consolidated Systems, Inc.; Metal Dek Group.
3. Epic Metals Corporation.
4. Marlyn Steel Decks, Inc.
5. New Millennium Building Systems, LLC.
6. Nucor Corp.; Vulcraft Group.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50 (345), G60 (Z180) zinc coating.
2. Deck Profile: As indicated on the drawings.
3. Profile Depth: As indicated on the drawings; 1-1/2 inches (38 mm) minimum.
4. Design Uncoated-Steel Thickness: As indicated; 0.0358-inch (0.91 mm) minimum.
5. Span Condition: Triple span or more.
6. Yield Strength: Minimum, 50,000 psi.
7. Side Laps: Overlapped or interlocking at Contractor's option and in coordination with the deck manufacturer.

2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Canam United States; Canam Group Inc.
2. Consolidated Systems, Inc.; Metal Dek Group.
3. Epic Metals Corporation.
4. Marlyn Steel Decks, Inc.
5. New Millennium Building Systems, LLC.
6. Nucor Corp.; Vulcraft Group.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 50 (345), G60 (Z180) zinc coating.
2. Profile Depth: As indicated on the drawings.
3. Design Uncoated-Steel Thickness: As indicated on the drawings; 0.0358-inch (0.91 mm) minimum.
4. Span Condition: Triple span or more.
5. Yield Strength: Minimum, 50,000 psi.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck. For drains, cut holes in the field.

I. Galvanizing Repair Paint: ASTM A 780.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

K. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction [and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].

1. Flat Paints and Coatings: 50 g/L.
2. Non-flat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
5. Zinc-Rich Industrial Maintenance Primers: 340 g/L.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2-inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8-inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 12-inches (305 mm) apart in the field of roof and 6-inches (150 mm) apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18-inches (450 mm) and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2- inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2-inches (51 mm) minimum.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld or mechanically fasten flanges to top of deck. Space welds or mechanical fasteners not more than 12-inches (305 mm) apart with at least one weld or fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld or mechanically fasten.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: 5/8-inch (16 mm), nominal.
2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12-inches (305 mm) apart, but not more than 18-inches (457 mm) apart.
3. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36-inches (914 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Fasten with a minimum of 1-1/2-inch- (38-mm-) long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/-2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped or butted at Contractor's option.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel items.

B. Downspout boots.

1.2 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

B. Section 05 12 00 - Structural Steel Framing

C. Section 05 51 33 - Metal Ladders.

D. Section 09 91 13 - Exterior Painting

E. Section 09 91 23 - Interior Painting

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi, 144 ksi, and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2025a.

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H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

I. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

K. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

L. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019, with Editorial Revision (2025).

M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

N. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

O. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Design steel channels and plates for openings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

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PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Plates: ASTM A283/A283M.

C. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

D. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

E. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.

B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of joists and masonry; galvanized finish.

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C. Lintels: 5 inches by 5 inches by 5/16 inches unless indicated otherwise; galvanized finish.

D. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; galvanized finish.

2.4 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
   1. Configuration: Angular.
   2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
   3. Finish: Manufacturer's standard factory applied powder coat finish.
   4. Color: To be selected by Architect from manufacturer's standard range.
   5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, and rubber coupling.

2.5 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items exposed to weather.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.6 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05 51 33 - METAL LADDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prefabricated ladders.

1.2 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders - Fixed - Safety Requirements; 2008 (Reaffirmed 2018).

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2026.

D. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2023.

E. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019, with Editorial Revision (2025).

1.3 SUBMITTALS

A. See Section 01 33 00 Submittals, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Designer's Qualification Statement.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

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PART 2 PRODUCTS

2.1 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B211/B211M.

B. Sheet Aluminum: ASTM B209/B209M.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M.

D. Aluminum-Alloy Bars: ASTM B211/B211M.

E. Screws, Bolts, Nuts, and Washers: Stainless steel.

F. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.2 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.3 PREFABRICATED LADDERS

A. Prefabricated Ladder: Aluminum unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Roof Access Ladders: Side rails spaced at 24 inches, with serrated rungs spaced 12 inches on center.
   2. Rung load capacity: Minimum 1000 pounds.
   3. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices.
   4. Security Doors: Formed 1/8 inch thick aluminum sheet. Security panels shall extend on both sides, perpendicular to door face, to within 2 inches of the wall. Security door shall be furnished with continuous aluminum piano hinge and heavy duty forged steel locking hasps.
   5. Finish: Mill finish aluminum.
   6. Manufacturers:
      a. O'Keeffe's Inc: www.okeeffes.com.
      b. Precision Ladders, LLC: www.precisionladders.com.
      c. UPNOVR, Inc: www.upnovr.com.

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d. Approved equal.

2.4 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall mounted handrails.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.

B. Section 04 20 00 - Unit Masonry: Placement of anchors in masonry.

C. Section 09 91 13 - Exterior Painting: Paint finish.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

D. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

F. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 SUBMITTALS

A. See Section 01 33 00 Submit, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
   1. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.

D. Fabricator's Qualification Statement.

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1.5 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

C. Fabricator Qualifications:
   1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Handrails and Railings:
   1. Kane Innovations: www.kaneinnovations.com/#sle.
   2. Kee Safety, Inc: www.keesafety.com/#sle.
   3. Patriot Custom Metals DBA PalmSHIELD: www.palmshieldlouvers.com/#sle.
   4. Approved equal.

2.2 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete, for welding anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   3. Provide thermal breaks complying with Section 07 21 00 - Thermal Insulation whether or not shown on drawings.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

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2.3 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Galvanizing: In accordance with requirements of ASTM A123/A123M.
1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.

2.4 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Weld connections that cannot be shop welded due to size limitations.
1. Weld in accordance with AWS D1.1/D1.1M.
2. Match shop welding and bolting.
3. Clean welds, bolted connections, and abraded areas.
4. Touch up shop primer and factory-applied finishes.
5. Repair galvanizing with galvanizing repair paint per ASTM A780/A780M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

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3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Nonstructural dimension lumber framing.

C. Rough opening framing for roof openings.

D. Sheathing.

E. Roofing nailers.

F. Roofing cant strips.

G. Preservative treated wood materials.

H. Fire retardant treated wood materials.

I. Miscellaneous framing and sheathing.

J. Communications and electrical room mounting boards.

K. Concealed wood blocking, nailers, and supports.

L. Miscellaneous wood nailers, furring, and grounds.

1.2 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.

B. Section 09 21 16 - Gypsum Board Assemblies for metal backing and flexible wood backing.

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2024).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

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D. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2024.

E. AWC (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; 2024, with Errata.

F. AWPA M4 - Standard for the Handling, Storage, Field Fabrication and Field Treatment of Preservative-Treated Wood Products; 2023.

G. AWPA U1 - Use Category System: User Specification for Treated Wood; 2025.

H. FM 1-49 - Perimeter Flashing; 2016.

I. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ITS (DIR) - Directory of Listed Products; Current Edition.

K. PS 1 - Structural Plywood; 2023.

L. PS 2 - Performance Standard for Wood Structural Panels; 2019.

M. PS 20 - American Softwood Lumber Standard; 2025.

N. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Provide technical data on fire retardant treatment, wood preservative materials, adhesives, and application instructions.

C. Product Data: Submit technical data on wood treatment.

D. Samples: For rough carpentry members exposed to view, submit two samples, ____ by ____ inch in size illustrating wood grain, color, and general appearance.

E. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

F. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

G. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
1. Species: Spruce-Pine-Fir (South), unless otherwise indicated.
2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing (2 by 2 through 2 by 6):
1. Species: Spruce-Pine-Fir
2. Grade: No. 2.

D. Joist, Rafter, and Small Beam Framing (2 by 6 through 4 by 16):
1. Species: Spruce-Pine-Fir
2. Grade: No. 2.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 3 or Utility Grade.
2. Boards: Standard or No. 3.
3. Coordinate with Section 09 21 16 - Gypsum Board Assemblies for metal backing and flexible wood backing.

F. Roofing Nailers:
1. Surface Burning Characteristics: Maximum flame spread index of 100; when tested in accordance with ASTM E84.
2. Lumber: S4S, No. 3 or Utility Grade.

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3. Boards: Standard or No. 3.

2.3 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Southern Pine.

E. Grade: No. 2, 2 Common, or Construction.

F. All exposed wood is to pressure treated.

2.4 CONSTRUCTION PANELS

A. Roof Sheathing, Type CDX. EXP. APA Rated:
1. Bond Classification: Exterior.
2. Span Rating: 24.
3. Performance Category: 5/8 PERF CAT unless indicated otherwise.

B. Wall Sheathing: PS1 type.
1. Bond Classification: Exterior.
2. Grade: Structural I Sheathing.
3. Span Rating: 16.
4. Performance Category: 1/2 PERF CAT unlness indicated othe.
5. Edge Profile: Square edge.

C. Parapet Sheathing: Plywood, PS 1, Grade C-D, Exposure I.

D. Coping Blocking and Roofing Nailers: Plywood, PS 1, Grade C-D, Exposure I.

E. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.5 FIRE-RETARDANT TREATMENT (FRT)

A. Factory-treat wood members in accordance with AWPA U1 and use category indicated.

B. Kiln-dry after treatment (KDAT) to maximum moisture content of 19 percent for sawn material and 15 percent for plywood.

C. Fabrication of FRT Wood:

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1. Ripping or milling of boards, lumber, and timber after treatment is not permitted.
2. Field cutting to length and drilling of holes in boards, lumber, and timber are permitted without additional treatment.
3. Field cutting and drilling of holes in plywood are permitted.

D. Label or brand FRT wood with classification mark of UL (DIR) or ITS (DIR) or other approved inspection agency, the treatment plant, name of treatment, species of wood, flame spread and smoke developed index, method of drying after treatment, and treating standard.

2.6 PRESSURE-PRESERVATIVE TREATMENT (PPT)

A. Factory-treat wood members in accordance with AWPA U1 and use category indicated.

B. Kiln-dry wood after treatment with waterborne preservative to maximum moisture content of 19 percent for lumber and 15 percent for plywood.

C. Fabricate to maximum extent possible before treatment.

D. Label preservative-treated wood with marking as required by AWPA U1 and ICC (IBC). Unless otherwise permitted by standard U1 and building code, include the following markings: AWPA U1, accredited inspection agency mark, treating plant identification, type of preservative, preservative retention, and permitted end use.

E. Field Treatment for Cuts and Holes in Preservative-Treated Wood: Comply with AWPA M4.

2.7 ACCESSORIES

A. Metal and Finish of Fasteners:
1. Fire-Retardant-Treated Wood:
   a. Nails, timber rivets, wood screws, and lag screws: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
2. Preservative-Treated Wood:
   a. Nails, timber rivets, wood screws, and lag screws - general use: Hot-dip galvanized steel complying with ASTM A153/A153M Class D.
3. Untreated Wood: Unfinished steel.

B. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for use with galvanized metals and stainless steel complying with ASTM F593 Group 2 for use with stainless steel metals, for high humidity and preservative-treated wood locations; unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Bolt or ballistic fastener for anchorages to steel.

C. Sill Flashing: See Section 07 62 00.

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2.8 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat wood in contact with roofing, flashing, or waterproofing.
      c. Do not use treated wood in direct contact with the ground.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.

PART 3 EXECUTION

3.1 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches and seal.

B. Install sill gasket under sill plate of framed walls bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

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B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by applicable codes and AWC (WFCM) Wood Frame Construction Manual.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet span as detailed. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

3.4 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

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D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide nonstructural framing and blocking to support the following:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.
10. Other wall- or ceiling-mounted items indicated on drawings.

3.5 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Fasten roof-related carpentry to resist wind uplift.
1. Secure minimum 2 by 6 wood nailers to structural concrete or reinforced concrete masonry unit walls or continuous structural steel or angle using 1/2 inch or 3/8 inch steel headed or plate anchor bolts with bolts and washers spaced 24 inches on center. Embed anchor bolts a minimum of 5 inches and countersink bolt holes a maximum of 3/4 inch. Stagger anchor bolts if the nailer is wider than 6 inches.
2. For fastening to steel or structural concrete deck, provide two staggered rows of screws with maximum fastener spacing within each row of 24 inches. Fasten into top flange of deck with fasteners of sufficient length to protrude 3/4 inch through the deck or minimum of 1 inch embedment into concrete.
3. Secure wood members, such as fascias, cant strips, and top nailers, up to 8 inches wide, to lower wood nailers using minimum 10 penny common nails or number 8 screws, minimum length of 3 inches and long enough to penetrate at least 1-1/2 inches into the lower wood nailer. Fasten in two staggered rows. Space fasteners within each row a maximum of 12 inches.

3.6 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. Nail panels to framing; staples are not permitted.

B. Wall and Parapet Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

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C. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.7 SITE-APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.8 CLEANING

A. Waste Disposal:
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

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SECTION 06 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

C. Factory finishing.

1.2 RELATED REQUIREMENTS

A. Section 12 36 00 - Countertops.

1.3 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; Current Edition.

B. BHMA A156.9 - Cabinet Hardware; 2020.

C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

C. Product Data: Provide data for hardware accessories.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum three years of experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

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B. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
5. Replace, repair, or rework all work for which certification is refused.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.7 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved equal.

2.2 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Cabinets:
1. Finish - Exposed Exterior Surfaces: Decorative laminate.
2. Finish - Exposed Interior Surfaces: Melamine.
3. Finish - Semi-Exposed Surfaces: Decorative laminate
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
6. Casework Construction Type: Type A - Frameless.
7. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
8. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
   a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
9. Adjustable Shelf Loading: 40 psf.
   a. Deflection: L/144.
10. Cabinet Doors and Drawer Fronts: Flush style.
11. Drawer Side Construction: Doweled or buiscuit-joined.

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2.3 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.4 THERMALLY FUSED LAMINATE PANELS

A. Thermally Fused Laminate (TFL): Melamine- or polyester-resin-saturated decorative papers; for fusion to composite wood substrates under heat and pressure.
1. Test in accordance with NEMA LD 3 Section 3.
2. Panel Core Substrate: Particleboard.
3. Only solid color is permitted.
4. Not permitted in exterior and interior exposed locations.
5. Color: Complimentary to exterior laminate color.

2.5 LAMINATE MATERIALS

A. Manufacturers:
1. Wilsonart LLC: www.wilsonart.com/#sle.
2. Approved equal.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
1. Provide specific types as indicated.
a. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, colors as indicated.
b. Vertical Surfaces: VGS, 0.028 inch nominal thickness, colors as indicated.
c. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, colors as indicated.
d. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, colors as indicated.
e. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.6 COUNTERTOPS

A. Countertops: See Section 12 36 00.

2.7 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

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C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.8 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards or multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

C. Shelf Rests: Plastic two-pin type with shelf hold-down clip, BHMA No. B04013.

D. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish, BHMA No. E07121 or E07041.

F. Catches: Magnetic, BHMA No. B03141.
1. Approved equal.

G. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: Heavy-Duty (100 pounds).
3. Mounting: Side mounted.
4. Stops: Integral type.

H. Hinges: European style concealed self-closing type, BHMA No. B01602 , steel with nickel-plated finish.
1. Provide restricted opening hinges for doors adjacent to walls, deep cabinets, or appliances.

2.9 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

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C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

E. Sand work smooth and set exposed nails and screws.

F. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

G. Finish work in accordance with AWI/AWMAC/WI (AWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 5, Varnish, Conversion.
      b. Stain: As selected by Architect.
      c. Sheen: Flat.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

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3.3 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 07 05 53 - FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Paint finish.

1.3 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

B. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.5 FIELD CONDITIONS

A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.

B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Partition Identification Labels:
   1. Fire Wall Signs, Inc
   2. Safety Supply Warehouse, Inc
   3. Approved equal.

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2.2 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).
   1. Provide minimum 3 inch lettering reading "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS" or similar, including rating.

B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl or paper sign with factory applied adhesive backing.

C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 91 23 for products.

D. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 PREPARATION

A. See Section 09 91 23 for substrate preparation for painted markings.

3.3 INSTALLATION

A. Locate markings as required by ICC (IBC).
   1. Mark all fire walls, fire barriers, fire partitions, smoke barriers, and smoke partitions in accessible concealed floor, floor-ceiling, or attic spaces at no more than 30 feet apart horizontally.

B. Install adhered markings in accordance with manufacturer's instructions.

C. Install applied markings in accordance with Section 09 91 23.

D. Install neatly, with horizontal edges level.

E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION

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SECTION 07 14 00 - FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cold-applied elastomeric polymer dispersion waterproofing.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

B. Section 04 20 00 - Unit Masonry: Masonry joints prepared to receive flashings.

C. Section 07 21 00 - Thermal Insulation: Insulation used for protective cover.

1.3 REFERENCE STANDARDS

A. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
   1. Require attendance by all affected installers, such as air barrier installers, plumbing and electrical trades who will penetrate the waterproofing, and overburden installers.
   2. Review preparation and installation procedures, including tricky details, installation sequencing, and coordination and scheduling necessary for related work.
   3. Discuss exposure limitations, warranty requirements, and protection of installed work.

1.5 SUBMITTALS

A. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.

B. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.

D. Digital photographs of each portion of the installation including atypical details.

E. Warranty Documentation:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than ten years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years of documented experience.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.8 WARRANTY

A. Installer Warranty: Provide 2-year warranty for waterproofing failing to resist penetration of water commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Cold-Applied Elastomeric Polymer Dispersion Waterproofing:
1. Henry Company, CM100, Basis of Design
2. Master Builders Solutions
3. Approved equal.

2.2 FLUID-APPLIED WATERPROOFING MATERIALS

A. Cold-Applied Elastomeric Polymer Dispersion Waterproofing:
1. Cured Thickness: 30 mil, 0.030 inch, minimum.
2. Suitable for installation over unit masonry and exterior sheathing substrates at waterproofing of window, door and CMU openings.
3. Water Vapor Permeance:
   a. Procedure A (Dry Cup): 0.05 perms (3.09 ng/Pa m2 sec)
   b. Procedure B (Inverted Wet Cup): 0.36 perms (20.6 ng/Pa m2 sec)
4. Hydrostatic Pressure Resistance: >0.69 MPa (100 psi) per ASTM D5385
5. Products:
   a. Henry Company CM100, Basis of Design
   b. Master Builders Solutions
   c. Approved equal.

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2.3 ACCESSORIES

A. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.

B. Protection Board: Rigid insulation; see Section 07 21 00.

C. Cant Strips: Premolded composition material.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

D. Verify that items penetrating surfaces to receive waterproofing are securely installed.

E. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

F. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.

D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Prepare building expansion joints at locations as indicated on drawings.

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3.3 INSTALLATION

A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.

B. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

C. At joints and cracks less than 1/2 inch in width including joints between horizontal and vertical surfaces, apply 12 inch wide strip of joint cover sheet.

D. At joints from 1/2 inch to 1 inch in width, loop joint cover sheet down into joint between 1-1/4 inch to 1-3/4 inch, and extend sheet at least 6 inches on either side of expansion joint.

E. Center joint cover sheet over joints, roll sheet into 1/8 inch thick coating of waterproofing material and apply second coat over sheet extending at least 6 inches beyond sheet edges.

F. Apply extra thickness of waterproofing material at corners, intersections, and angles.

G. Seal membrane and flashings to adjoining surfaces.
   1. Install termination bar along edges.
   2. Install counterflashing over exposed edges.

3.4 INSTALLATION - PROTECTION BOARD

A. Place protection board directly against cured membrane; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

3.5 FIELD QUALITY CONTROL

A. Take digital photographs of each portion of the installation prior to covering.

B. Provide daily on-site attendance of roofing and insulation manufacturer's representative during installation of this work.

C. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.
   1. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.
   2. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
   3. When area is proven watertight, drain water and remove dam.

3.6 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

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SECTION 07 21 00 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, underside of floor slabs, over roof deck, over roof sheathing, and exterior wall behind rainscreen wall finish.

B. Batt insulation and vapor retarder in exterior wall construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

A. Section 07 27 00 - Air Barriers: Separate air barrier materials.

1.3 REFERENCE STANDARDS

A. ASTM C240 - Standard Test Methods for Testing Cellular Glass Insulation Block; 2021.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2022.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2025.

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

H. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

I. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

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K. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2026.

L. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on project site during and after installation. Present on-site documentation upon request.

1.5 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org:
1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.6 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

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B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

C. Insulation Inside Masonry Cavity Walls: Polyisocyanurate board.

D. Insulation Over Wood Framed Walls, Continuous: Polyisocyanurate board.

E. Insulation in Wood Framed Walls: Batt insulation with integral vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
5. Complies with fire resistance requirements specified as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Exterior Wall Boards: Square edges.
7. Foundation Boards: Shiplap or tongue-and-groove edges with grooved faces.
8. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
9. Products:
   a. DuPont de Nemours, Inc; Styrofoam Brand Cavitymate Plus; Styrofoam Brand Scoreboard: building.dupont.com.
   b. Owens Corning Corporation; FOAMULAR NGX Type 250 Next Generation Extruded; FOAMULAR NGX Type INSUL-DRAIN Next Generation Extruded : www.ocbuildingspec.com.
   c. Approved equal.

B. Polyisocyanurate (ISO) Board Insulation for Wall Assemblies: Rigid cellular foam, comply with ASTM C1289.
1. Classifications:
   a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      1) Class 2 - Faced with coated glass fiber mat facers on both major surfaces of core foam.
      2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
      3) Thermal Resistance, R-Value 12 at 2 inch thick; , minimum, at 75 degrees F.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Comply with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
5. Board Size: 48 inch by 96 inch.
6. Board Thickness: 2.0 inch.

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7. Board Edges: Square.
8. Products:
   a. RMax, Inc. , Durasheath
   b. Atlas Roofing Corporation; EnergyShield Pro:
   c. Carlisle Coatings & Waterproofing, Inc; R2+ Sheathe:
   d. Hunter Panels; Xci 286:
   e. Approved equal.

C. Cellular Polyurethane Thermal Break Board Insulation: High-strength closed-cell structure board with following characteristics.
1. Board Size: 48 by 96 inches.
2. Board Thickness: 2 inches unless indicated otherwise.
3. Thermal Resistance: R-value of 3.85 per inch, minimum, at 75 degrees F, minimum, in accordance with ASTM C518 test methods.
4. Apparent Thermal Conductivity: K-value of 0.26 Btu inch/hr sq ft degrees F, minimum, in accordance with ASTM C518 test methods.
5. Compressive Strength: 210 psi, minimum, in accordance with ASTM D1621 test methods.
6. Compressive Modulus: 6,155 psi, minimum, in accordance with ASTM D1621 test methods.
7. Products:
   a. Armatherm{CH#385927}: www.armatherm.com.
   b. Fabreeka; Thermal Insulation Material (TIM) RF Series 1020: www.fabreeka.net.
   c. Approved equal.

2.3 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
1. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
2. Facing: Aluminum foil, flame spread 25 rated; one side.
3. Products:
   a. CertainTeed Corporation; CertaPro AcoustaTherm Batts: www.certainteed.com.
   b. Johns Manville; Fiberglass: www.jm.com.
   c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com.
   d. Approved equal.

B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
2. Thickness: As indicated on drawings.
3. Products:
   a. Johns Manville; Mineral Wool TempControl Batts: www.jm.com.
   b. ROCKWOOL; COMFORTBATT: www.rockwool.com.

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c. Thermafiber, Inc; Ultrabatt: www.thermafiber.com.
d. Approved equal.

2.4 ACCESSORIES

A. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be mechanically fastened to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
1. Length as required for thickness of insulation material and penetration of deck substrate.

B. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on foundation perimeter.
1. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION AT CAVITY WALLS

A. Secure impale fasteners to substrate at following frequency:
1. One per insulation board in center of board.

B. Install boards to fit snugly between wall ties with wall tie washers holding board in place.

C. Install boards horizontally on walls.
1. Place boards to maximize adhesive contact.
2. Install in running bond pattern.
3. Butt edges and ends tightly to adjacent boards and protrusions.
4. Fill gaps larger than 1/4 inch with spray foam insulation.
5. Place impale fastener locking discs.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

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3.4 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing slab.

3.5 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

G. Tape seal tears or cuts in vapor retarder.

H. Coordinate work of this section with construction of air barrier seal, see Section 07 27 00.

3.6 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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SECTION 07 27 00 - AIR BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air barriers.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 Rough Carpentry

1.3 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.4 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

D. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section or roofing section, whichever is earlier.
   1. Require attendance by all affected installers, such as roofing, plumbing and electrical trades who will penetrate the air barrier, insulation installers, and finish wall system installers.
   2. Review preparation and installation procedures, including tricky details, installation sequencing, and coordination and scheduling necessary for related work.
   3. Discuss exposure limitations, warranty requirements, and protection of installed work.

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1.6 SUBMITTALS

A. Product Data: Provide data on material characteristics, performance criteria, limitations, and NFPA 285 compliance.

B. Shop Drawings: Provide drawings of special joint conditions.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Digital photographs of each portion of installation, including atypical details.

1.7 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org:
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

B. Air Barrier Association of America (ABAA) Evaluated Air Barrier Assemblies; www.airbarrier.org: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

D. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

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1.8 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Air Barrier at Masonry Cavity Walls: self-adhered sheet or fluid applied coating/membrane.

B. Air Barrier at Wood Framed Walls: self-adhered sheet or fluid applied coating/membrane.

2.2 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air Barrier Sheet, Self-Adhered:
   1. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedures A - Desiccant Method and B - Water Method, at 73.4 degrees F.
   3. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
   5. Comply with NFPA 285 requirements for wall assembly.
   6. Seam and Perimeter Tape: As recommended by sheet manufacturer.
   7. Products:
      a. 3M; Vapor Permeable Air Barrier 3015VP
      b. Dorken Systems Inc; DELTA-VENT SA
      c. SIGA Cover Inc; SIGA-Majvest 500 SA:
      d. Soprema Inc; SopraSEAL Stick VP
      e. VaproShield, LLC; WrapShield SA - Self-Adhered
      f. Approved equal.

B. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.
   1. Air Barrier Coating:
      a. Wet Film Thickness (WFT) or Dry Film Thickness (DFT): As indicated, to meet both air and water vapor performance requirements.
      b. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
      c. Water Vapor Permeance: 11 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedures A - Desiccant Method and B - Water Method, at 73.4 degrees F.

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d. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 90 days of weather exposure.
e. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
f. Comply with NFPA 285 requirements for wall assembly.
g. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
h. Products:
    1) Carlisle Coatings and Waterproofing, Inc; Fire Resist Barrithane VP (20 mils DFT)
    2) DuPont de Nemours, Inc; Tyvek Fluid Applied WB+ (25 mils DFT)
    3) PROSOCO, Inc; R-GUARD Cat 5 (12 to 15 mils WFT)
    4) Soprema Inc; SopraSEAL LM 204 VP (20 mils DFT)
    5) Approved equal.

2.3 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.
1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch, nominal thickness.

C. Primer: Liquid applied polymer.

D. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement waived if not installed on roof.
1. Width: 4 inches.
2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.

E. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
1. Width: 3-1/2 inches or 5-1/2 inches to match width of sill.
2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.

F. Preformed Transition Membrane: Semirigid silicone or polyester composition, tapered edges, ribbed back, tear resistant.
1. Products:
    a. Henry Company; Moistop Corner Shield: www.henry.com.
    b. Pecora Corporation; KL-Span: www.pecora.com.
    c. Tremco Commercial Sealants & Waterproofing; Proglaze ETA System: www.tremcosealants.com.
    d. Substitutions: See Section 01 60 00 - Product Requirements.
    e. Approved equal.

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G. Stainless Steel Flashing: Flexible flashing with 2 mil, 0.002 inch thick Type 304 stainless steel sheet, 8 mil, 0.008 inch of butyl adhesive and siliconized release liner.
   1. Roll Length: 50 feet long.
   2. Width: 6 inches wide.
   3. Overlap joints at least 2 inches.

H. Liquid Flashing: One part, fast curing, nonsag, elastomeric, gun grade, trowelable.

I. Liquid Flashing: One part, fast curing, nonsag, gun grade, trowelable.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.

C. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Self-Adhered Sheets:
   1. Prepare substrate in accordance with sheet manufacturer's installation instructions; fill and tape joints in substrate and between dissimilar materials.
   2. Lap sheets shingle fashion to shed water and seal laps airtight.
   3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.

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4. Use same material, or other material approved by sheet manufacturer, to seal to adjacent substrates, and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

E. Fluid-Applied Coatings or Membranes:
1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
2. Where exterior masonry veneer is being installed, install masonry anchors before installing air barrier over masonry; provide airtight seal around anchors.
3. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

F. Openings and Penetrations in Exterior Air Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto air barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
4. At head of openings, install flashing under air barrier extending at least 2 inches beyond face of jambs; seal air barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.4 FIELD QUALITY CONTROL

A. Coordination of ABAA Tests and Inspections:
1. Provide testing and inspection required by ABAA QAP.
2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

B. Do not cover installed air barriers until required inspections have been completed.

C. Take digital photographs of each portion of installation prior to covering up air barriers.
1. Provide particular attention to atypical details.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

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SECTION 07 31 13 – ASPHALT SHINGLE ROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt roofing shingles.

B. Leak barrier and roof deck protection.

C. Metal flashing associated with shingle roofing.

D. Attic ventilation.

1.2 RELATED SECTIONS

A. Section 06 10 00- Rough Carpentry: Framing, wood decking, and roof sheathing.

B. Section 07 62 00- Flashing and Sheet Metal: Sheet metal flashing not associated with shingle roofing; gutters and downspouts.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)- Annual Book of ASTM Standards

1. ASTM A 653/A 653M- Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

2. ASTM B 209- Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

3. ASTM B 370- Standard Specification for Copper Sheet and Strip for Building Construction.

4. ASTM D 3018- Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.

5. ASTM D 3161- Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).

6. ASTM D 3462 – Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules.

7. ASTM D 4586- Standard Specification for Asphalt Roof Cement, Asbestos-Free.

8. ASTM D 7158- Standard Test Method for Wind-Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method).

9. ASTM E 903 – Standard Test Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres. ***Cool and reflector series only***

B. Underwriters Laboratories (UL)- Roofing Systems and Materials Guide (TFWZ.R21)

1. UL 790- Tests for Fire Resistance of Roof Covering Materials.

2. UL 997- Wind Resistance of Prepared Roof Covering Materials.

3. UL 2218 – Impact Resistance of Prepared Roof Coverings Materials.

C. Asphalt Roofing Manufacturers Association (ARMA)

D. Sheet Metal and Air Conditioning Contractors National Association, 1nc. (SMACNA)- Architectural Sheet Metal Manual.

E. National Roofing Contractors Association (NRCA)

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 and the glossary of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual for definitions of roofing terms related to this section.

1.5 SUBMITTALS

A. Submit copies of product data sheets, detail drawings and samples for each type of roofing product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all primary roofing products, including shingles, underlayment, leak barrier, and ventilation, by a single manufacturer.

B. Installer Qualifications: Installer must be approved for installation of all roofing products to be installed under this section.

1.7 REGULATORY REQUIREMENTS

A. Provide a roofing system achieving an Underwriters Laboratories (UL) Class A fire classification.

B. Install all roofing products in accordance with all federal, state and local building codes.

C. All work shall be performed in a manner consistent with current OSHA guidelines.

1.8 PREINSTALLATION MEETING

A. General: For all projects in excess of 250 squares of roofing, a pre-installation meeting is strongly recommended.

B. Timing: The meeting shall take place at the start of the roofing installation, no more than 2 weeks into the roofing project.

C. Attendees: Meeting to be called for by manufacturer’s certified contractor. Meeting’s mandatory attendees shall include the certified contractor and the manufacturer’s representative. Non-mandatory attendees shall

include the owner's representative, architect or engineer's representative, and the general contractor's representative.

D. Topics: Certified contractor and manufacturer's representative shall review all pertinent requirements for the project, including but not limited to, scheduling, weather considerations, project duration, and requirements for the specified warranty.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store all products in manufacturer's unopened, labeled packaging until they are ready for installation.

B. Store products in a covered, ventilated area, at temperature not more than 110 degrees F (43 degrees C); do not store near steam pipes, radiators, or in direct sunlight.

C. Store bundles on a flat surface. Maximum stacking height shall not exceed GAF's recommendations. Store all rolls on end.

D. Store and dispose of solvent-based materials in accordance with all federal, state and local regulations.

1.10 WEATHER CONDITIONS

A. Proceed with work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations

1.11 WARRANTY

A. Provide to the owner a Golden Pledge® Ltd Warranty:

1. Eligibility requirements: Roofs installed by a manufacturer approved contractor only. Requires at least 5 qualifying accessory products in addition to manufacturers shingles.

2. Manufacturing defects:

a. Commercial or Multi-Residential Building:

1) 40 years with a 25-year Smart Choice® Protection Period (non-prorated). Accessories installed with lifetime shingles are also covered with a 40-year limited warranty with a 25-year Smart Choice® Protection Period (non-prorated).

3. Workmanship

a. Twenty-Five (25) years

4. Wind Warranty Coverage:

a. (HDZ)LayerLock-labeled Shingles:

1) WindProven™ Limited Wind Warranty – 15-year limited warranty with no maximum wind speed. Requires installation of 6 nails per shingle.

5. Algae Warranty Coverage:

a. StainGuard Plus PRO™ labeled Shingles (UHDZ only):

1) 30 year limited warranty with 15-year Smart Choice® Protection Period (non-prorated) *when used with StainGuard Plus™ labeled ridge cap shingles*.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. GAF, 1 Campus Drive, Parsippany NJ 07054. Tel: 877-423-7663, Basis of Design

B. Or Approved Equal

2.2 SHINGLES

A. Self sealing, granule surfaced, asphalt shingle with a strong fiberglass reinforced Micro Weave® core and StainGuard Plus PRO™ protection, which prevents pronounced discoloration from blue-green algae through formulation/unique blends of granules. Architectural laminate styling with a 5 5/8 inch exposure. New StrikeZone™ Nailing Area with proprietary LayerLock™ Technology provides up to 30% faster nailing and up to 600% larger nailing target. Features manufacturer's patented High Definition® color blends and enhanced shadow effect with a patent-pending Dual Shadow Line feature. UL 790 Class A rated; ASTM D 7158, Class H; ASTM D 3161, Class F; ASTM D 3018, Type 1; ASTM D 3462; AC438; CSA A123.5; Dade County Approved, Florida Building Code Approved, Texas Dept of Insurance Approved, ICC Report Approval ESR-1475 and ESR-3267. **Timberline® UHDZ™** Ultra High Definition® Lifetime Shingles, by GAF, or approved equal

1. Color: As selected by Architect from manufacturers' full range to match existing.

2.3 HIP AND RIDGE SHINGLES

A. Bullnose style hip and ridge cap shingle matching the color of selected roof shingle, available in 10" widths. Each bundle covers approx. 20 lineal feet (6.10m) with a 8" exposure. **Timbercrest™** Premium SBS-Modified Ridge Cap Shingles, by GAF, or approved equal

2.4 STARTER STRIP

A. Self sealing starter shingle designed for all roof shingles. Each bundle covers approx. 120 lineal feet (36.58m). **ProStart™ Starter Strip** by GAF, or approved equal.

2.5 LEAK BARRIER

A. Self-adhering, self sealing, bituminous leak barrier surfaced with a smooth polyethylene film. Approved by UL, Dade County, ICC, State of Florida and Texas Department of Insurance. Each Roll contains approx. 200 sq ft. (18.6 sq.m.), 36" X 66.7' (0.9m x 20.3m), and 60 mils thick. **StormGuard® Leak Barrier,** by GAF, or approved equal.

2.6 SHINGLE UNDERLAYMENT

A. Premium, water repellant, breather type non-asphaltic underlayment. UV stabilized polypropylene construction. Meets or exceeds ASTM D226 and D4869. Approved by Dade Country, Florida Building Code, and ICC. Each roll contains approximately 10 squares (1003 sq. ft.) of material and is 54" x 223'. Deck-Armor™ Premium Breathable Roof Deck Protection, by GAF, or approved equal.

2.7 ROOFING CEMENT

A. Asphalt Plastic Roofing Cement meeting the requirements of ASTM D 4586, Type I or II.

2.8 ROOF ACCESSORIES

A. Durable, all metal design that helps provide tough protection at plumbing pipe penetrations. Has no exposed seals or gaskets and completely encapsulates plumbing pipes for a streamlined, finished look on the roof. Ball and socket "pivot" feature allows for simple rooftop pitch adjustment and installation on roofs 3:12-12:12. Passes the 110 mph wind-driven rain test per TAS-100(A) and UL 2218 Class 4 impact resistance test, Master Flow™ Pivot™ Pipe Boot Flashing by GAF, or approved equal.

2.9 ATTIC VENTILATION

A. Ridge Vents

1. Rigid plastic ridge ventilator designed to allow the passage of hot air from attics while prohibiting snow infiltration. For use in conjunction with eave/ soffit intake ventilation products. Provides 18.0 sq inches (11613 sq.mm/m) NFVA per lineal foot. Each package contains 40 lineal feet (12.19m) of vent. Cobra® Snow Country Advanced™ Ridge Vent (includes 3" (76mm) galvanized ring shank nails), by GAF, or approved equal.

2.10 NAILS

A. Standard round wire, zinc-coated steel or aluminum; 10 to 12 gauge, smooth, barbed or deformed shank, with heads 3/8 inch (9mm) to 7/16 inch (11mm) in diameter. Length must be sufficient to penetrate into solid wood at least 3/4 inch (19mm) or through plywood or oriented strand board by at least 1/8 inch (3.18mm).

2.11 METAL FLASHING

A. .26 gauge hot-dip galvanized steel sheet, complying with ASTM A 653/A 653M, G90/Z275.

B. 16-oz/sq ft (0.56mm) copper sheet, complying with ASTM B 370.

C. 0.032-inch (0.8mm) aluminum sheet, complying with ASTM B 209.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until the roof deck has been properly prepared.

B. If roof deck preparation is the responsibility of another installer, notify the architect or building owner of unsatisfactory preparation before proceeding.

3.2 PREPARATION – TEAR OFF

A. Remove existing roofing down to the roof deck as indicated on drawings.

B. Verify that the deck is dry, sound, clean and smooth. It shall be free of any depressions, waves, and projections. Cover with sheet metal, all holes over 1 inch (25mm) in diameter, cracks over 1/2 inch (12mm) in width, loose knots and excessively resinous areas.

C. Replace damaged deck with new materials.

D. Clean deck surfaces thoroughly prior to installation of eaves protection membrane and underlayment.

3.3 PREPARATION – NEW CONSTRUCTION

A. Clean deck surfaces thoroughly prior to installation of eaves protection membrane and underlayment.

B. At areas that receive eaves protection membrane, fill knotholes and cracks with latex filler.

C. Install crickets on the upslope side of all chimneys in the north, any chimney wider than 24” (610mm), and on all roofs steeper than 6/12.

3.4 INSTALLATION OF LEAK BARRIER

A. General:

1. Install using methods recommended by GAF, in accordance with local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.

B. Eaves:

1. Install eaves edge metal flashing tight with fascia boards; lap joints 2 inches (51mm) and seal with plastic cement or high quality urethane sealant; nail at the top of the flange.

3.5 INSTALLATION OF UNDERLAYMENTS

A. General:

1. Install using methods recommended by GAF, in accordance with local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.

B. Eaves:

1. Install eaves edge metal flashing tight with fascia boards; lap joints 2 inches (51mm) and seal with plastic cement or high quality urethane sealant; nail at the top of the flange.

2. In the north, and on all roofs between 2/12 and 4/12 (low slopes) install GAF leak barrier up the slope from eaves edge a full 36 inches (914mm) or to at least 24 inches (610 mm) beyond the interior “warm wall”. Lap ends 6 inches (152mm) and bond.

C. Valleys:

1. Install eaves protection membrane at least 36 (914mm) inches wide and centered on the valley. Lap ends 6 inches (152mm) and seal.

D. Hips and Ridges:

1. Install GAF leak barrier along entire lengths. If ridge vents are to be installed, position the GAF leak barrier so that the ridge slots will not be covered.

E. Field of Roof:

1. Deck-Armor shall be installed over a clean, dry deck.
2. Install Weather Watch® or StormGuard® Leak Barrier at eaves, valleys, rakes, skylights, dormers and other vulnerable leak areas.
3. Lay Deck-Armor™ over deck and overlap 3” (76mm) at side laps and 6” (152mm) at end laps.
4. For exposure to rain or snow, overlap 12” (305mm) at end laps.
5. For side and end laps: fasten Deck-Armor 12” (305mm) o.c. (6” (152mm)o.c. for high wind areas).
6. For middle of the roll: fasten Deck-Armor 24” (610mm) o.c. (12” (305mm) o.c. for high wind areas).
7. For exposure to rain or snow, completely cover all side laps, end laps and fasteners with tape.
8. For long term exposure see complete Deck-Armor installation instructions for side lap detail.
9. If roof may be exposed to high winds, apply tape over all fasteners at the center of the roll to prevent rain or snow from entering at the fasteners.
10. For slopes between 2:12 to less than 4:12, a double application of Deck-Armor is required. See complete Deck-Armor installation instructions for more information.

F. Penetrations:

1. Vent pipes: Install a 24 inch (610 mm) square piece of eaves protection membrane lapping over roof deck underlayment; seal tightly to pipe.
2. Vertical walls: Install eaves protection membrane extending at least 6 inches (152mm) up the wall and 12 inches (305mm) on to the roof surface. Lap the membrane over the roof deck underlayment.

3. Rake Edges: Install metal edge flashing over eaves protection membrane and roof deck underlayment; set tight to rake boards; lap joints at least 2 inches (51mm) and seal with plastic cement; secure with nails.

3.6 INSTALLATION OF SHINGLES

A. General:

1. Install in accordance with GAF's instructions and local building codes. When local codes and application instructions are in conflict, the more stringent requirements shall take precedence.

2. Minimize breakage of shingles by avoiding dropping bundles on edge, by separating shingles carefully (not by "breaking" over ridge or bundles), and by taking extra precautions in temperatures below 40 degrees F (4 degrees C).

3. Handle carefully in hot weather to avoid scuffing the surfacing, or damaging the shingle edges.

4. Mansard and steep slope applications: For roof slopes greater than 21” per foot (1750mm/m), shingle must be hand sealed with asphalt plastic cement conforming to ASTM D4586 Type I or II. DO NOT use on vertical side walls.

B. Placement and Nailing:

1. For maximum wind resistance along rakes, install any GAF starter strip containing sealant or cement shingles to underlayment and each other in a 4" (102mm) width of asphalt plastic roof cement.

2. Secure with six (6) nails per shingle per GAF’s instructions or local codes.

3. Placement of nails varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.

4. Nails must be driven flush with the shingle surface. Do not overdrive or under drive the nails.

5. Shingle offset varies based on the type of shingle specified. Consult the application instructions for the specified shingle for details.

C. Valleys

1. Install valleys using the "closed cut valley" method:

a. Run the first course of shingles from the higher roof slope across the valley at least 12 inches (305mm).

b. Run succeeding courses of shingles from the lower roof slope across the valley at least 12 inches (305mm) and nail not closer than 6 inches (152mm) to center of valley.

c. Run shingles from the upper roof slope into the valley and trim 2 inches (51mm) from the center line.

D. Penetrations

1. All Penetrations are to be flashed according to GAF, ARMA and NRCA application instructions and construction details.

3.7 INSTALLATION OF ATTIC VENTILATION

A. General

1. Ventilation must meet or exceed current F.H.A., H.U.D. and local code requirements.

B. Ridge / Soffit ventilation

1. Install ridge vent along the entire length of ridges:
2. Cut continuous vent slots through the sheathing, stopping 6 inches (152mm) from each end of the ridge.
3. On roofs without ridge board, make a slot 1 inch (25mm) wide, on either side of the peak (2” (51mm) overall).
4. On roofs with ridge board, make two slots 1-3/4 inches (44.5mm) wide, one on each side of the peak (3 ½” (89mm) overall).
5. Install ridge vent material along the full length of the ridge, including uncut areas.
6. Butt ends of ridge vent material and join using roofing cement.

3.8 PROTECTION

A. Protect installed products from foot traffic until completion of the project.

B. Any roof areas that are not completed by the end of the workday are to be protected from moisture and contaminants.

END OF SECTION

SECTION 07 42 93 – METAL SOFFIT PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concealed-fastener, interlocking aluminum soffit panels.
   2. Solid and vented aluminum soffit panels.
   3. Related trim, closures, flashings, accessories, and fasteners required for a complete installation.

B. Related Requirements:
   1. Section 06 10 00 - Rough Carpentry.
   2. Section 07 62 00 - Sheet Metal Flashing and Trim.
   3. Section 07 92 00 - Joint Sealants

1.2 REFERENCES

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM D 3359 - Standard Test Methods for Rating Adhesion by Tape Test.

C. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

D. ASTM D 4585 - Standard Practice for Testing Water Resistance of Coatings Using Controlled Condensation.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

1.3 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's current technical data, including:
   1. Product description and dimensions.
   2. Material and thickness.
   3. Panel profile.
   4. Finish and color options.
   5. Solid or vented panel configuration.
   6. Installation requirements.

B. Shop Drawings: Submit drawings indicating:
   1. Panel layout and direction of installation.

2. Locations of joints, splices, terminations, and transitions.
3. Perimeter and intermediate support conditions.
4. Trim and accessory profiles.
5. Fastener locations and attachment methods.
6. Provisions for thermal movement.

C. Samples: Submit manufacturer's standard color and finish samples showing selected color and texture.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's installation instructions.

B. Manufacturer's product warranty.

C. Documentation of compliance with specified finish requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer regularly engaged in manufacturing aluminum soffit panel systems of the type specified.

B. Installer Qualifications: Installer experienced in the installation of concealed-fastener metal soffit systems similar in material, design, and extent to that required for the Project.

C. Preinstallation Conference: Conduct conference at Project site before installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and accessories in manufacturer's original, unopened packaging.

B. Store materials off the ground, under cover, and protected from moisture, dirt, abrasion, and damage.

C. Prevent contact between aluminum panels and dissimilar metals or materials capable of causing galvanic corrosion.

D. Handle panels to prevent damage to finishes and edges.

1.7 FIELD CONDITIONS

A. Do not install panels until substrates are sound, dry, and capable of supporting the soffit system.

B. Coordinate installation with adjacent roofing, flashing, fascia, wall, and ceiling construction.

1.8 WARRANTY

A. Provide manufacturer's standard limited finish warranty for fluoropolymer-coated panels.

B. Warranty shall cover finish performance against chalking and fading for the manufacturer's specified warranty period and conditions.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. ATAS International, Inc.; Wind-Lok® Soffit Panels, MPS120 and MPV120, Basis of Design

B. Or Approved Equal

2.2 ALUMINUM SOFFIT PANELS

A. Product: Wind-Lok® Soffit Panels.

B. Type:
1. Solid Soffit Panel: ATAS MPS120.
2. Vented Soffit Panel: ATAS MPV120.

C. Panel Configuration:
1. Concealed-fastener, V-groove profile.
2. Interlocking “hook, pull, and fasten” system.
3. Panel coverage: 12 inches.
4. Panel height: 3/8 inch.
5. Standard panel length: 12 feet.

D. Material:
1. Aluminum sheet complying with ASTM B 209.
2. Thickness: 0.032 inch minimum, unless otherwise indicated on Drawings.

E. Ventilation:
1. Provide solid panels where indicated.
2. Provide lanced, vented panels where indicated.
3. Coordinate vented panel locations with the required soffit ventilation design.

F. Texture:
1. Smooth.

2.3 FINISHES

A. Fluoropolymer Finish: 70 percent PVDF coating complying with AAMA 2605 performance requirements.

B. Color: As selected by Architect from manufacturer's standard colors.

C. Provide uniform color and texture throughout each visually continuous area.

D. Anodized Finish: Where indicated, provide manufacturer's clear satin or dark bronze anodized finish for solid MPS120 panels.

2.4 ACCESSORIES

A. Provide manufacturer's standard or recommended accessories required for a complete installation, including:
1. Perimeter trim.
2. Starter and termination components.
3. Inside and outside corners.
4. End closures.
5. Splice and joint accessories.
6. Closures and fillers.
7. Flashings and transition components.
8. Related formed aluminum components.

B. Accessories shall be compatible with panel material and finish.

C. Provide matching aluminum sheet or coil stock for field-fabricated components where approved by the manufacturer.

2.5 FASTENERS

A. Provide concealed fasteners recommended by the soffit panel manufacturer for the substrate and conditions of installation.

B. Fasteners shall be corrosion-resistant and compatible with aluminum panels and accessories.

C. Do not use exposed fasteners on panel faces unless specifically indicated or approved by the manufacturer.

2.6 FABRICATION

A. Fabricate panels and accessories accurately to profiles and dimensions indicated.

B. Fabricate components to allow for thermal movement and building movement without buckling, distortion, oil-canning, or failure of joints.

C. Form exposed surfaces free of excessive waviness, buckles, dents, and other defects.

D. Fabricate joints and transitions in accordance with manufacturer's written instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, framing, blocking, and adjacent construction for conditions affecting installation.

B. Verify that supporting surfaces are properly aligned, level, plumb, sound, and free of conditions that would prevent proper installation.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of dirt, debris, oil, grease, and other contaminants that would interfere with installation.

B. Install required blocking, framing, and support members before installing soffit panels.

C. Coordinate installation with adjacent construction to maintain required clearances and ventilation paths.

3.3 INSTALLATION

A. Install panels and accessories in accordance with manufacturer's written installation instructions and approved Shop Drawings.

B. Install panels true to line, level, and plane.

C. Install panels using the manufacturer's concealed-fastener interlocking system.

D. Engage panel interlocks fully and completely.

E. Provide required perimeter supports and attachment points.

F. Install solid and vented panels at locations indicated.

G. Maintain required ventilation openings and do not obstruct vented panel openings.

H. Install accessories, trim, closures, and flashings in a neat, weather-resistant manner.

I. Provide adequate allowance for thermal movement in accordance with manufacturer's recommendations.

J. Do not force panels into position or create stresses that could cause buckling, distortion, or failure of interlocking joints.

K. Cut panels and accessories using methods recommended by the manufacturer. Protect exposed finishes from damage during cutting and fabrication.

L. Isolate aluminum from incompatible dissimilar metals and materials capable of causing galvanic corrosion.

3.4 CLEANING

A. Remove protective films, dirt, debris, metal shavings, oil, and other contaminants from installed panels.

B. Clean panels in accordance with manufacturer's written recommendations.

C. Do not use cleaning agents or methods that could damage the aluminum substrate or finish.

3.5 PROTECTION

A. Protect installed soffit panels from damage caused by subsequent construction activities.

B. Replace damaged panels and accessories that cannot be repaired to the satisfaction of the Architect.

END OF SECTION

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber-cement siding.

1.2 RELATED REQUIREMENTS

A. Section 07 27 00 Air Barriers

1.3 REFERENCE STANDARDS

A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets; 2026.

B. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2025.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
1. Manufacturer's requirements for related materials to be installed by others.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Installation methods, including nail patterns.

C. Test Reports: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

D. Test Report: Applicable model code authority evaluation report (e.g. ICC-ES).

E. Installer's Qualification Statement.

F. Maintenance Instructions: Periodic inspection recommendations and maintenance procedures.

G. Warranty: Submit copy of manufacturer’s warranty, made out in Owner’s name, showing that it has been registered with manufacturer.

H. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

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1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section with minimum three years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products under waterproof cover and elevated above grade, on a flat surface.

1.7 WARRANTY

A. See Section 01 70 00 Project Closeouot for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Installation Warranty for Building Rainscreen Assembly: Installer of exterior rainscreen assembly (including air/vapor barrier and attachments, framing, and exterior panels) to provide 10-year warranty that includes coverage for defective materials and/or workmanship. This warranty will also clearly include materials, labor, necessary activity to access these areas, and removal of any materials to effect repairs and restore to watertight conditions.

PART 2 PRODUCTS

2.1 FIBER-CEMENT SIDING

A. Panel Siding: Vertically oriented panels made of cement and cellulose fiber formed under high pressure with integral surface texture, complying with ASTM C1186, Type A, Grade II; with machined edges, for nail attachment.
   1. Fire Performance: Tested in accordance with, and complying with acceptance criteria of NFPA 285.
   2. Texture: Smooth.
   3. Length (Height): 96 inches, nominal.
   4. Width: 48 inches.
   5. Thickness: 5/16 inch, nominal.
   6. Finish: Factory applied stain.
   7. Color: As selected by Architect from manufacturers full range of available colors.
   8. Warranty: 50 year limited; transferable.
   9. Products:
      a. James Hardie Building Products, Inc., Reveal Panel System with Artisan Trim, Basis of Design
      b. Allura, a division of Plycem USA, Inc
      c. Approved Equal

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2.2 ACCESSORIES

A. Trim: Same material and texture as siding.

B. Metal Trim: Extruded aluminum alloy 6063-T5 temper.
1. Finish: Clear anodized.

C. Fasteners: Galvanized or corrosion resistant; length as required to penetrate, 1-1/4 inch, minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrate, clean and repair as required to eliminate conditions that would be detrimental to proper installation.

B. Verify that water-resistant barrier has been installed over substrate completely and correctly.

C. Do not begin until unacceptable conditions have been corrected.

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

3.2 PREPARATION

A. Install Sheet Metal Flashing:
1. Above horizontal trim in field of siding.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and recommendations.
1. Read warranty and comply with terms necessary to maintain warranty coverage.
2. Install in accordance with conditions stated in model code evaluation report applicable to location of project.
3. Use trim details indicated on drawings.
4. Touch up field cut edges before installing.
5. Pre-drill nail holes if necessary to prevent breakage.

B. Over Steel Studs: Use hot-dipped galvanized self-tapping screws, with the points of at least three screws penetrating each stud the panel crosses and at panel ends.

C. Allow space for thermal movement between both ends of siding panels that butt against trim; seal joint between panel and trim with specified sealant.

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D. Joints in Vertical Siding: Install Z-flashing in horizontal joints between successive courses of vertical siding.

E. Do not install siding less than 6 inches from surface of ground nor closer than 1 inch to roofs, patios, porches, and other surfaces where water may collect.

F. After installation, seal joints except lap joints of lap siding; seal around penetrations, and paint exposed cut edges.

3.4 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 07 54 23 THERMOPLASTIC-POLYOLEFIN ROOFING (TPO) - GAF

PART 1 GENERAL

1.1 SECTION INCLUDES

A. TPO roofing membrane for new construction applications.

B. Coverboards.

C. Insulation.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers, curbs, and blocking.

B. Section 07 71 00 - Roof Specialties: Manufactured copings, fascias, gravel stops, and other flashing-related items.

1.3 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

C. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel.

D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

F. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing.

G. ASTM D7877 - Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes.

H. ASTM D8231 - Standard Practice for the Use of a Low Voltage Electronic Scanning System for Detecting and Locating Breaches in Roofing and Waterproofing Membranes.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.

J. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

K. ASTM G155 - Standard Practice for Operating Xenon Arc Lamp Apparatus for Exposure of Materials.

L. FM (AG) - FM Approval Guide.

M. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction.

N. FM 4474 - American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures.

O. FM DS 1-28 - Wind Design.

P. NRCA (RM) - The NRCA Roofing Manual.

Q. NRCA (WM) - The NRCA Waterproofing Manual.

R. SPRI RP-4 - Wind Design Standard for Ballasted Single-Ply Roofing Systems.

S. UL (DIR) – Online Certifications Directory.

T. UL (FRD) - Fire Resistance Directory.

U. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.

V. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Attendees: Owner, Contractor, Architect, Installer, roofing manufacturer's technical representative, and installers whose work interfaces with or affects the work of this section.
   2. Review project requirements, including the following:
      a. Preparation and acceptance of substrates.
      b. Sequencing and coordination between trades and acceptance of substrates for roofing installation.
      c. Approved materials, details and sequencing for transitions, tie-ins, flashings, drainage, penetrations, and curbs.
      d. Protection of installed materials.
      e. Repair procedures.

1.5 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Provide data for roofing system materials, components, and accessories.

C. Shop Drawings: Include roof plans and details showing terminations, flashings, penetrations, attachment methods, tie-ins, and interface with adjacent work.
   1. Indicate insulation thicknesses and slopes.
   2. Include project-specific tapered insulation layout prepared by roofing manufacturer.
   3. Roof plan indicating orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.

D. Samples for Verification: Submit two samples 6 by 6 inches (150 by 150 mm) in size of roof membrane, insulation, and coverboard.

E. Manufacturer's Letter: Certify products meet or exceed specified requirements.

F. Wind Uplift Resistance Submittal: Indicate compliance with wind uplift performance requirements.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Specimen Warranty: For approval.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section with at least three years of documented experience and approved by manufacturer for specified warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals unbroken and labels intact, unless otherwise indicated.

B. Store materials in weather protected environment, clear of ground and moisture, and within temperature range required by manufacturers.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

D. Protect liquids and foam insulation from direct exposure to sunlight.

1.8 FIELD CONDITIONS

A. Contact roofing manufacturer to confirm acceptable assemblies for special applications. Conform with manufacturer's instructions.

B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing materials when ambient temperature is below 40 degrees F (5 degrees C) unless otherwise permitted by manufacturer in writing.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be covered the same day.

F. Schedule applications so no partially completed sections of roof are left exposed at end of workday.

1.9 WARRANTY

A. See Section 01 70 00 – Project Closeout for additional warranty requirements.

B. System Guarantee: Provide manufacturer's system guarantee.
   1. Guarantee: GAF EverGuard® Diamond Pledge NDL Roof Guarantee.
   2. Term: 20 years.
   3. Liability Limit: No dollar limit on covered repairs.
   4. Scope of Coverage:
      a. Repair of covered leaks resulting from manufacturing defects, ordinary wear and tear, or workmanship in applying the covering materials, subject to certain exclusions.
      b. Leaks due to winds up to 55 mph (88 km/hr), excluding hurricanes and tornados.

C. Extended Correction Period: Correct defective work within 2-year period commencing on date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
   1. GAF; 1 Campus Drive; Parsippany, NJ 07054; Toll Free Tel: 877-423-7663; Email: designservices@gaf.com: www.gaf.com.
   2. Or Approved Equal

B. Source Limitations: Obtain components for roofing system from roof membrane manufacturers or manufacturers approved by roof membrane manufacturer.

2.2 ROOFING SYSTEM

A. Roofing System Description: Listed from top of roof down.
   1. Single Ply Membrane: Adhered.
   2. Cover Board: High density polyisocyanurate board; adhered.
   3. Insulation: Minimum one layer, having maximum board thickness of 1 inch at stair canopy and minimum two layers of 2.5 inches at addition roof.
      a. Total System R-value (RSI-value): Minimum R-30 at addition roof.
      b. Slope: Provide minimum slope of 1/4 inch per foot (1:48) by means of roof structure.
      c. Top Layers: Polyisocyanurate foam board, noncomposite; adhered to base layer.
      d. Bottom Layer: Polyisocyanurate foam board, noncomposite; mechanically fastened to roof deck.
      e. Crickets: Tapered insulation of same type as specified for top layer; minimum slope of 1/2 inch per foot (1:24) unless otherwise indicated in drawings.

B. Performance Requirements:
   1. General: Roofing system to withstand specified uplift pressures, thermally induced movement, and exposure to ordinary weather conditions.
   2. Material Compatibility: Provide roofing materials and accessories compatible with one another under conditions of service and application, as demonstrated by roof membrane manufacturer based on testing and field experience.
   3. Wind Uplift Resistance: Design to withstand wind uplift forces in accordance with applicable local building code requirements as demonstrated by roofing manufacturer's independent testing.
      a. Roofing System: Tested in accordance with FM 4474, UL 580, or UL 1897.
      b. Design Pressures: As indicated in Structural Drawings.
   4. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 90, when calculated in accordance with ASTM E1980.

2.3 MEMBRANE MATERIALS

A. Membrane:
   1. TPO Membrane: Thermoplastic polyolefin sheet complying with ASTM D6878/D6878M with internally reinforced scrim.
      a. Smooth Membrane: 60 mil, 0.060 inch (1.5 mm) nominal TPO thickness.
   2. Impact Resistance: Membrane to resist impact damage when tested in accordance with the "Resistance to Foot Traffic Test" in FM 4470.
   3. Accelerated Weathering: Roof to withstand 2000 hours of exposure when tested in accordance with ASTM G155.
   4. Color: White
   5. Products:

a. GAF EverGuard® TPO Membrane: www.gaf.com.
b. Or Approved Equal

B. Membrane Attachment: Spray bonding adhesive as recommended by roofing manufacturer.
1. VOC Content: Maximum 90 g/L.

C. Flexible Flashing: Manufacturer's standard TPO sheet flashing matching primary membrane in type and color, minimum 55 mil, 0.055-inch (1.4 mm) thickness.

2.4 COVER BOARDS

A. Cover Board: High-density polyisocyanurate (ISO) insulation board, complying with ASTM C1289, and the following characteristics:
1. Classification: Type II, Class 4 - faced with coated or uncoated glass-fiber-mat facers on both major surfaces of core foam.
2. Compressive Strength: Grade 2, 80 psi (Grade 2, 550 kPa).
3. Thickness: 1/2 inch (12.7 mm).
4. Insulation Thermal Resistance, R-value (RSI-value): 2.5 (0.44), nominal.
5. Products:
a. GAF EnergyGuard® HD Polyiso Cover Board: www.gaf.com.
b. Or Approved Equal

B. Adhesive Attachment: Low rise foam as recommended by roofing manufacturer.

C. Fasteners: As recommended and approved by roofing manufacturer.

2.5 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
1. Classification: Type II, Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
2. Mold Growth Resistance: Passing ASTM D3273.
3. Compressive Strength: Grade 2, 20 psi (138 kPa) minimum.
4. Board Size: 48 by 96 inches (1220 by 2440 mm).
5. Tapered Board: Same type as primary roof insulation.
6. Products:
a. GAF; EnergyGuard® Polyiso Insulation: www.gaf.com.
b. Or Approved Equal

B. Adhesive Attachment: Low rise foam as recommended by roofing manufacturer.

C. Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

2.6 ACCESSORIES

A. Miscellaneous Accessories: Provide pourable sealers, primers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

B. Prefabricated Flashing Accessories: Same material as membrane in manufacturer's standard thicknesses, including:
   1. Inside corners, outside corners, universal corners, and fluted corners.
   2. Square tube wraps.
   3. Conical pipe boots and split pipe boots.
   4. Pourable sealer pockets.
   5. T-Joint cover patches.

C. Wood Nailers, Curbs, and Blocking: See Section 06 10 00.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturers.

E. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.1 inch (2.5 mm) thick.

F. Sealants: As recommended by membrane manufacturer.

G. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

H. Welded Flexible Walkways: Heavy-duty, slip-resistant, textured TPO walkway roll, suitable for maintenance traffic and visually distinctive from roof membrane.
   1. Roll Width: 34 inches (860 mm).
   2. Surface Color: Gray.
   3. Products:
      a. GAF EverGuard® TPO Walkway Roll: www.gaf.com.
      b. Or Approved Equal

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of moisture, snow or ice.

E. Verify roof openings, curbs, and penetrations through roof are solidly set, and nailing strips are in place.

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

3.2 PREPARATION - WOOD DECK

A. Verify wood deck conforms with manufacturer's minimum requirements.
1. Minimum Thickness: 15/32-inch (12 mm) for wood sheathing or nominal 1 x 4-inch (25 x 100-mm) for wood planks.
2. Wood Joist Spacing: Not exceeding 24 inches (609 mm) on center.
3. Sheathing: Installed with all four sides bearing on and secured to joists and cross blocking. “H” clips are not acceptable.

B. Verify flatness and tightness of joints in wood decking; fill knot holes with latex filler.

C. Confirm dry deck by moisture meter with 12 percent moisture maximum.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION, GENERAL

A. Perform work in accordance with manufacturer's instructions.

B. Do not apply roofing components during cold or wet weather conditions outside of manufacturer’s approved conditions.

C. Do not apply roofing membrane when ambient temperature is outside of manufacturer’s required temperature range.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be covered the same day.

F. Coordinate this work with installation of associated counterflashing installed by other sections as work of this section proceeds.

G. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

H. Install night seal at end of each workday or when rain is forecast. Provide temporary seals to prevent water from entering completed sections of roofing system. Ensure stagger and offset of underlying insulation to prevent thermal breaks. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 INSTALLATION - INSULATION

A. Installation Over Wood Decking: Attach insulation in accordance with roofing manufacturer's instructions.
   1. Base Layer: Mechanically fastened base layer of insulation units over substrate.
   2. Upper Layers: Fully adhered insulation per manufacturer’s requirements to resist uplift pressures.

B. Lay subsequent layers of insulation with joints staggered from joints of preceding layer in accordance with manufacturer's instructions.

C. Place tapered insulation to required slope pattern in accordance with manufacturer's instructions.

D. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

E. At roof drains, slope insulation down to roof drains with each side equal to the diameter of the drain bowl plus 36 inches (914 mm).

F. Do not install more insulation that can be covered with membrane in same day.

3.5 INSTALLATION - COVER BOARD

A. Install cover board over insulation with joints staggered from joints of insulation in accordance with manufacturer's instructions.

B. Trim cover board neatly to fit around penetrations and projections as directed by cover board manufacturer.

C. Adhere cover board using insulation adhesive in accordance with roofing manufacturer's instructions.

3.6 INSTALLATION - MEMBRANE

A. Install membrane and flashings in accordance with roofing system manufacturer's instructions.

B. Roll out membrane, free from wrinkles or tears.

C. Accurately align roof membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Shingle joints on sloped substrates in direction of drainage where possible.

D. Adhered Application:
   1. Adhesive: Apply adhesive at prescribed rate and in conformance with manufacturer's instructions. Bond membrane and apply pressure by means required by manufacturer. Adhere one roll before proceeding to adjacent rolls. Avoid trapping air between membrane and substrate.
   2. In addition to adhering, mechanically fasten roof membranes securely at terminations, penetrations, and perimeter of roofing.

E. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings. Test lap edges with probe to verify seam weld continuity in accordance with manufacturer's technical bulletins.

F. At intersections with vertical surfaces terminate and seal top of sheet flashings with termination bars secured to nailing strips or structural backing or in conformance with roofing manufacturer's approved details.
   1. Insert flashing into reglets and secure.

G. Extend membrane under copings, gravel stops, edge metals and secure to outside face of wall.

H. Around roof penetrations, seal flanges and flashings with flexible flashing.

I. Install roofing expansion joints where indicated. Make joints watertight.

J. Coordinate installation of roof drains, sumps, and related flashings. Terminate membranes according to manufacturer's approved details. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

K. Walkways: Install walkways in accordance with roofing system manufacturer's instructions at the following locations. Provide manufacturers' minimum clearance between units.
   1. Perimeter of each rooftop unit.
   2. Between each rooftop unit location, creating continuous paths connecting rooftop unit locations.
   3. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   4. Top and bottom of each roof access ladder.
   5. Locations indicated on Drawings.
   6. Other locations required by roof membrane manufacturer's requirements.

3.7 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Colntrol for independent field inspection requirements, and requirements for monitoring quality of specified product installations.

B. Provide on-site attendance of roofing manufacturer's representative during installation of this work.

1. Probe heat welded seams and test seams in accordance with manufacturer's recommendations.

C. Repair or remove and replace components of roofing system where tests or inspections indicate they do not comply with specified requirements. Perform repairs using manufacturer's approved repair procedures.

D. Perform additional testing and inspecting at Contractor's expense to determine if repaired or additional work complies with specified requirements.

3.8 CLEANING

A. See Section 01 70 00 – Project Closeout for additional requirements.

B. Properly dispose of all product wrappers, pallets, cardboard, scrap, waste and debris. Replace damaged material with new materials.

C. Clean adjacent construction where soiled by work of this section. Comply with manufacturer of adjacent construction's instructions and procedures.

3.9 PROTECTION

A. Protect installed roofing system from construction operations.

B. Correct deficiencies in work in accordance with warranty requirements. Repair or replace defaced or damaged finishes caused by work of this section.

END OF SECTION 07 54 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, flashings, counterflashings, counterflashings, gutters, gutters, downspouts, downspouts, sheet metal roofing, exterior penetrations, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.

1.2 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry

B. Section 06 10 00 - Rough Carpentry

C. Section 07 31 13 - Asphalt Shingles

D. Section 07 71 00 - Roof Specialties

E. Section 07 72 00 - Roof Accessories

F. Section 07 92 00 - Joint Sealants

1.3 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement; 2025.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

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1.5 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.6 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with ten years of experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch thick; plain finish shop pre-coated with silicone modified polyester coating.

B. Stainless Steel: ASTM A666/A666M, Type 304 alloy, soft temper, 28 gauge, 0.0156 inch thick; smooth No. 4 - Brushed finish.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

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F. Fabricate flashings to allow toe to extend 2 inches over roofing . Return and brake edges.

2.3 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.

B. Downspouts: Rectangular profile.

C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM).

D. Accessories: Profiled to suit gutters and downspouts.

E. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3,000 psi at 28 days, with minimum 5 percent air entrainment.

F. Downspout Boots: Steel.

G. Downspout Extenders: Same material and finish as downspouts.

H. Seal metal joints.

2.4 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Primer: Zinc chromate type.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

F. Reglets: Recessed type, stainless steel; face and ends covered with plastic tape, unless otherwise noted.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

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3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.3 INSTALLATION

A. Insert flashings into reglets to form tight fit; secure in place with plastic wedges.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Seal metal joints watertight.

F. Secure gutters and downspouts in place with concealed fasteners.

G. Connect downspouts to downspout boots, and seal connection watertight.

H. Set splash pads under downspouts at all existing downspouts not tied into downspout boots.

END OF SECTION

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SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, gravel stops, and vents.

1.2 RELATED REQUIREMENTS

A. Section 07 72 00 - Roof Accessories

1.3 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2026.

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

C. NRCA (RM) - The NRCA Roofing Manual; 2019.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
   1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.

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2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Material: Formed aluminum sheet, 0.050 inch thick, minimum.
4. Finish: 70 percent polyvinylidene fluoride.
5. Color: As selected by Architect from manufacturer's full range.

B. Pipe and Penetration Flashing: Base compatible with shingle and TPO roof systems, and capable of accomodating pipes sized between 3/8 inch and 12 inches.
1. Color: To match surrounding roof field..

C. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

D. Counterflashings: Factory fabricated and finished sheet metal that overlaps top edges of base flashing by at least 4 inches, and designed to snap into through-wall flashing or reglets with lapped joints.

E. Pipe Penetration Wall Seal: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket.
1. Outlet Cover Color: _____.

F. Pipe Penetration Wall Seal and Insulated Piping Protection System: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket and having mechanical line insulation with PVC protective cover.
1. Outlet Cover Color: As selected by Architect from manufacturer's full range of colors.

2.2 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.3 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

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3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

END OF SECTION

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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof curbs.

1.2 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders; Current Edition.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.3 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

D. Warranty Documentation:
1. Submit manufacturer warranty.
2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

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1.5 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Provide manufacturer's standard five year warranty.

PART 2 PRODUCTS

2.1 ROOF CURBS

A. Manufacturers:
1. Bilco; Standard Curb, Basis of Design
2. Approved equal.

B. Curb height as indicated on drawings and made of 14 gauge galvannealed steel. Curb shall be formed with a 3 1/2" flange with 7/16" holes provided for securing to the roof deck. The curb shall be equipped with an integral metal Cap flashing of the same gauge and materials as the curb, fully welded at the corners, that features the Bil-Clip flashing system, including stamped tabs, 6" on center, to be bent inward to hold single ply roofing membrane securely in place.

C. Curb insulation shall be rigid, high density fiberboard of 2" thickness on outside of curb.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

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

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

END OF SECTION

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SECTION 07 84 00 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2024.

D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2024.

E. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-Story Test Apparatus; 2025b.

F. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2024.

G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a, with Editorial Revision (2024).

H. FM (AG) - FM Approval Guide; Current Edition.

I. FM 4991 - Approval Standard of Firestop Contractors; 2013.

J. ITS (DIR) - Directory of Listed Products; Current Edition.

K. UL (FRD) - Fire Resistance Directory; Current Edition.

L. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

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1.3 SUBMITTALS

A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

C. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

1.4 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
   3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.
   2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
   3. Verification of minimum three years documented experience installing work of this type.
   4. Verification of at least five satisfactorily completed projects of comparable size and type.
   5. Licensed by local authorities having jurisdiction (AHJ).

1.5 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

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PART 2 PRODUCTS

2.1 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

C. Fire Ratings: Refer to drawings for required systems and ratings.

2.2 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

2.3 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

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B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.3 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.4 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 07 92 00 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2024.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

H. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

I. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

J. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2025).

K. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

L. SWRI (VAL) - SWR Institute Validated Products Directory; Current Edition.

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1.3 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Substrates for which laboratory adhesion and/or compatibility testing is required.
   7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   8. Sample product warranty.
   9. Certification by manufacturer indicating that product complies with specification requirements.
   10. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

G. For exterior sealants: Installation Plan: Submit at least four weeks prior to start of installation.

H. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

I. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

J. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

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K. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

L. Executed warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
4. Allow sufficient time for testing to avoid delaying the work.
5. Deliver sufficient samples to manufacturer for testing.
6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
1. Identification of testing agency.
2. Name(s) of sealant manufacturer's field representatives who will be observing.
3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    a. Test date.
    b. Copy of test method documents.
    c. Age of sealant upon date of testing.
    d. Test results, modeled after the sample form in the test method document.
    e. Indicate use of photographic record of test.

F. Field Quality Control Plan:
1. Visual inspection of entire length of sealant joints.
2. Nondestructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
    a. Test the entire length of every sealant joint.
3. Destructive field adhesion testing of sealant joints, except interior sealant joints.

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a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1,000 linear feet, and one test per 1,000 linear feet thereafter, or once per floor on each elevation.
b. If any failures occur in the first 1,000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

4. Field testing agency's qualifications.
5. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

G. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

H. Nondestructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Continuous Method.

I. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.

1.5 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

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C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.1 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
   a. Wall expansion and control joints.
   b. Joints between door, window, and other frames and adjacent construction.
   c. Joints between different exposed materials.
   d. Openings below ledge angles in masonry.
   e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
      1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
      2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated.
   c. Other joints indicated below.
3. Do not seal the following types of joints:
   a. Intentional weep holes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints where installation of sealant is specified in another section.
   e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.
2. Lap Joints between Manufactured Metal Panels: Butyl rubber, noncuring.
3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane traffic-grade sealant.

C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.

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D. Interior Wet Areas: Bathrooms, restrooms, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

F. Areas Where Tamper-Resistance is Required: In all secure areas

2.2 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.

2.3 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. FDA suitable for indirect food additives, NSF recognized for direct food contact, or USDA accepted for use in meat and poultry processing plants.
   2. Products:
      a. Pecora Corporation; Pecora 898 NST (Non-Staining Technology): www.pecora.com.
      b. Polymeric Systems; 601 FG: www.polymericsystems.com.
      c. Sika Corporation; Sikasil GP: www.usa-sika.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
      e. Approved equal.

B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

C. Tamper-Resistant Polyurethane Sealant: ASTM C920, Grade NS, Uses M, G, and A; single or multicomponent; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 12-1/2 percent, minimum.
   2. Hardness Range: 50 to 60, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Products:
      a. Pecora Corporation; Dynaflex:Basis of Design
      b. Approved equal.

D. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; non-vapor permeable; intended for fully concealed applications.

2.4 SELF-LEVELING JOINT SEALANTS

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A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's full range.
   3. Products:
      a. Pecora
      b. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com.
      c. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
      e. Approved equal.

2.5 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
   3. Open Cell: 40 to 50 percent larger in diameter than joint width.
   4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

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D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
   3. Arrange for sealant manufacturer's technical representative to be present during tests.
   4. Record each test on Preinstallation Adhesion Test Log as indicated.
   5. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
   6. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

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H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

C. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

D. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet, notify Architect immediately.

E. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

F. Repair destructive test location damage immediately after evaluation and recording of results.

3.5 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION

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SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

C. Thermally insulated hollow metal doors with frames.

D. Detention security hollow metal doors and frames.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2025.

C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2026.

D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2024.

E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2025.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2026.

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I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

J. ASTM C143/C143M - Standard Test Method for Slump of Concrete; 2026a.

K. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

M. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009

O. ITS (DIR) - Directory of Listed Products; Current Edition.

P. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

Q. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2024.

R. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.

S. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

T. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2025, with Amendment (2024).

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

V. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.

W. UL (DIR) - Online Certifications Directory; Current Edition.

X. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 33 00 - Submittals for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

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C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Hollow Metal Doors and Frames:
1. Curries; an Assa Abloy Group company
2. Mesker; Dormakaba Group
3. Steelcraft; an Allegion Brand
4. Approved Equal
5. Approved equal.

B. Bullet-Resistant and Detention Security Hollow Metal Doors and Frames:
1. Mesker; Dormakaba Group; BR Series Bullet-Resistant Doors and Frames
2. Republic Doors
3. Security Metal Products Corporation
4. Approved equal.

2.2 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

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1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Typical Door Face Sheets: Flush.
5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 4 - Maximum-duty.
    b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 2 - Seamless.
    d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thickness: 1-3/4 inches, nominal.
4. Weatherstripping: Refer to Section 08 71 00.

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5. Door Finish: Factory primed and field finished.

C. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 4 - Maximum-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches, nominal.

D. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 3 - Extra Heavy-duty.
   b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 1 - Full Flush.
   d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   a. Attach fire rating label to each fire rated unit.
4. Door Core Material: Mineral board.
5. Door Thickness: 1-3/4 inches, nominal.

E. Commercial Security and Detention Security Doors; Interior and Exterior:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
   a. Level 4 - Maximum-duty.
   b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
   c. Model 2 - Seamless.
   d. Door Face Metal Thickness: 12 gauge as indicated on drawings.
2. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
3. Door Thickness: As required to meet requirements indicated.
4. Hinge Rail and Reinforcement: Non-beveled edge, reinforced with continuous steel channel, 12 gauge, 0.093 inch minimum metal thickness, welded at 5 inch on center maximum, and compatible with 4-1/2 inch full mortise template and continuous geared hinges.

2.4 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

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B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Full profile/continuously welded type, thermally broken.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
3. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Knock-down type at gypsum board walls, and face welded type at masonry walls.
1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

E. Door Frames, Fire-Rated: Face welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

F. Commercial and/or Detention Security-Resistant Door Frames: With same security resistance as door; face welded or full profile/continuously welded construction, ground smooth, fully prepared and reinforced for hardware installation.
1. Frame Metal Thickness: 10 gauge as indicated on drawings.

G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.5 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
1. Color: As selected by Architect from manufacturer's standard range.

C. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 ACCESSORIES

A. Food Passes: Built-in stop positions the food pass door as a shelf when open. Key Operated springlock provides positive security and prevents unauthorized use.
1. Frame: 7 gauge mild steel

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2. Lock: Supplied less lock
3. Hinges: 3"H x 3"W x 5/32" TK mild steel with cold rolled steel, non-removable pin
4. Frame Size: 1'8 - 1/4" L x 10"W
5. Clear Opeing: 5"H x 1' 3-1/4"W
6. Manufacturer:
    a. Southern Folger Food Pass SKU SS262, Basis of Design

B. Door Window Frames: Door window frames with glazing securely fastened within door opening.
1. Size: As indicated on Drawings.
2. Frame Material: 10 gauge as indicated on drawings, galvanized steel.
3. Metal Finish: Gray polyester powder coating.
4. Glazing: As indicated on Drawings

C. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

D. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

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B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 71 00.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes.

3.4 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

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SECTION 08 31 00 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.2 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; Current Edition.

B. UL (FRD) - Fire Resistance Directory; Current Edition.

1.3 SUBMITTALS

A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

B. Shop Drawings: Indicate exact position of each access door and/or panel unit.

C. Manufacturer's Installation Instructions: Indicate installation requirements.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Wall- and Ceiling-Mounted Units: Factory-fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
   1. Material: Steel, unless indicated otherwise.
   2. Style: Exposed frame with door surface flush with frame surface.
      a. Gypsum Board Mounting Criteria: Use drywall bead type frame.
   3. Door Style: Single thickness with rolled or turned in edges.
   4. Frames: 16 gauge, 0.0598 inch, minimum thickness.

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5. Single Steel Sheet Door Panels: 1/16 inch, minimum thickness.
6. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
    a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
7. Steel Finish: Primed.
8. Primed and Factory Finish: Polyester powder coat; color _____.
9. Door/Panel Size: 12 inch by 12 inch, unless indicated otherwise.
10. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    c. Latch/Lock: Tamperproof tool-operated cam latch.
    d. Number of Locks/Latches Required: As recommended by manufacturer for size of unit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

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08 33 00 – ROLLING SERVICE DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Springless rolling service doors

1.2 RELATED SECTIONS

A. Division 05 Section - Metal Fabrications

B. Division 08 Section - Door Hardware

C. Division 09 Sections - Painting

1.3 REFERENCES

A. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.

B. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.

C. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

D. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

F. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

G. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

I. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00 Submittals Requirements.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

1.8 PROJECT CONDITIONS

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

1.9 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

A. Warranty: Manufacturer’s limited door and operator system, to be free from defects in materials and workmanship for 3 years or 500,000 cycles, whichever occurs first.

B. PowderGuard Finish
1. PowderGuard Zinc Base Coat applied to guides, bottom bar, headplates plus PowderGuard Premium applied to curtain and top coat for guides, bottom bar, headplates: Manufacturer’s limited Zinc Finish warranty for 4 years.

PART 2 -PRODUCTS

2.1 MANUFACTURERS

A. Overhead Door Corporation; Model 625 Series Stormtite Insulated Door, Basis of Design

B. Alpine Overhead Doors, Inc.

C. C.H.I. Overhead Doors

D. Or Approved Equal

2.2 ROLLING DOORS

A. Curtain: Interlocking roll-formed slats as specified. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
1. Flat profile type for doors up to 40’ 0” wide. The front slat shall be fabricated of 24 gauge galvanized steel .The back slat shall be 24 gauge galvanized steel.
2. Slat cavity shall be filled with CFC-free foamed in place, polyurethane insulation.
3. R-Value: 7.7; U Value: 0.13
4. Sound Rating STC-21

B. Finish:

1. Galvanized Steel: Slats and hood shall be galvanized steel in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked on prime paint, ferrous surfaces shall receive one coat of rust-inhibitive primer.
2. Stainless steel: Slats and hood shall be stainless steel with No. 4 Satin Finish.
3. Aluminum: Slats and hood shall be aluminum with clear anodized finish.

C. Color: Powder coating finish in color as selected by architect from manufacturers standard colors.

D. Windload Design: 20 PSF

E. Weatherseals: Vinyl bottom seal, exterior guide and interior hood seals, Interior guide seals, Lintel Seals.

F. Bottom Bar: Two prime painted steel (stainless steel) angles, minimum thickness 1/8" bolted back to back to reinforce curtain in the guides.

G. Guides: Three structural steel angles with minimum thickness of 3/16". Guides shall be weatherstripped with a vinyl weather seal at each jamb, on the exterior curtain side.

H. Brackets: Hot rolled steel (stainless steel) to support counterbalance, curtain and hood.

I. Counterbalance: Helical torsion spring type designated for standard 50,000 cycle life design. Counterbalance shall be housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03" per foot of span. Counterbalance shall be adjustable by means of an adjusting tension wheel.

J. Hood: Stainless Steel 24 gauge, with intermediate supports as required. Provide with internal hood baffle weatherseal.

K. Manual Operation: Chain Hoist (crank operation)

L. Locking: Interior bottom bar slide boltlock and chain keeper locks for chain hoist operation.

M. Wall Mounting Condition: Between jambs mounting

N. Vision Lites: 3" x 5/8" uniformly spaced opening with double Plexiglas covers.

PART 3 -EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

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

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

C. Coordinate with adjacent work to ensure proper clearances and allow for maintenance.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 92 00.

F. Install perimeter trim and closures.

G. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.4 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 08 56 53 - SECURITY WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Detention windows, with glazing.

1.2 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Installation of anchorage items embedded in masonry.

B. Section 07 27 00 - Air Barriers: Sealing frames to weather-resistive barrier installed on adjacent construction.

C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2026.

C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

D. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

E. SSPC-Paint 33 - Coal Tar Mastic Coating, Cold-Applied; 2023.

1.4 SUBMITTALS

A. Product Data: Manufacturer's published data showing materials, construction details, dimensions of components, and finishes.

B. Shop Drawings: Drawings prepared specifically for this project, showing plans, elevations, sections, details of construction, anchorage to other work, hardware, and glazing.
   1. For new work show required opening dimensions and allowance for field deviation.

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C. Test Reports: Test reports for specific window model and glazing to be furnished, showing compliance with specified requirements; window and glazing may be tested separately, provided window test sample adequately simulates the glazing to be used.
   1. Include testing agency qualifications.
   2. For structural, forced entry, and ballistic tests, provide details on method of anchorage to test frame.

D. Samples for Selection of Applied Finishes: Color charts for factory finishes.

E. Coordination Drawings: For each window opening, show locations and details of items necessary to anchor windows that must be installed by others, in sufficient detail that installer of those items can do so correctly without reference to the actual window itself.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent testing agency able to show experience in conducting tests of the type specified.

1.6 WARRANTY

A. Provide manufacturer's warranty agreeing to repair or replace windows and window components that fail within three years after Date of Substantial Completion due to, but not limited to, the following:
   1. Structural failure, failure of welds, and deterioration of metals and finishes beyond that expected under detention use and normal weathering.
   2. Failure of glazing due to excessive deflection of supporting members under wind load.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Detention Windows:
   1. Hope's Windows, Inc; STB30 Series, Basis of Design.
   2. Optimum Windows
   3. Claborn Manufacturing
   4. Or approved equal.

B. Provide windows from a single manufacturer.

2.2 ASSEMBLIES

A. Detention Windows:
   1. Dimensions, profiles, features, and performance specified and indicated on drawings are required; do not deviate unless specifically approved by Architect under substitution procedures.

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2. Design to fit openings indicated on drawings; design to accommodate deviation of actual construction from dimensions indicated on drawings.
3. Fabricate frames and sash with corners mitered or coped full depth with concealed welded joints.
4. Design anchorages to provide performance equivalent to that required for window unit; provide anchorages at least equivalent to those by which the tested units were anchored to the test frame.
5. Separate dissimilar metals to prevent corrosion by galvanic action by painting contact surfaces with primer or with sealant or tape recommended by manufacturer for the purpose.
6. Weld components before finishing and in concealed locations, to greatest extent possible; minimize distortion and discoloration of finish; remove residue of welding; grind exposed welds smooth and finish to match.
7. Label units to indicate which side is which, such as inside/outside or secure/non-secure; use labels that are removable after installation but durable enough not to be lost during delivery, storage, handling, and installation.

B. Exterior Window Requirements: Comply with following performance requirements as well as other specified criteria.
1. Structural Performance: Capable of withstanding wind loads as specified by code without permanent deformation or breakage of components, when tested in accordance with ASTM E330/E330M.
2. Deflection of Framing Members Supporting Glass: Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edge to less than 1/175 of their lengths under specified design load.
3. Air Leakage of Fixed Windows: 0.10 cfm/sq ft maximum leakage for fixed window units when tested at 6.27 psf pressure difference in accordance with ASTM E283/E283M.
4. Water Penetration: None, when tested in accordance with ASTM E331 at test pressure difference of 2.86 psf.
5. Provide thermally improved construction using integral, low conductance thermal barrier in frame and sash members.
6. Provide weep holes and internal water passages to conduct infiltrated water to exterior.
7. Provide water shed members where sash frames lap in wrong direction to shed water.

2.3 DETENTION WINDOWS

A. Detention Windows: Factory-assembled fixed glazing frames reglazable from exterior without disassembly of ventilator frame; attach removable components with security fasteners that are not removable without the use of appropriate tools.
1. Glazing: As identified on drawings.
   a. Units to be glazed in field.
2. Framing and Sash: Formed galvannealed steel sheet perimeter framing, muntins, and glazing stops; hot-rolled steel ventilator framing; baked enamel finish.
3. Framing and Glazing Stops: Formed galvannealed steel sheet; with muntins of same material; baked enamel finish.

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2.4 ASSEMBLY COMPONENTS

A. Galvannealed Formed Steel Framing: ASTM A653/A653M galvannealed to A60/ZF180 coating; 12 gauge, 0.1046 inch minimum base metal thickness.

B. Frame Anchors: Mild steel plates, shapes, or bars, concealed in completed construction; provide anchorage devices as necessary to securely fasten windows to adjacent construction; use security fasteners for exposed anchors.
   1. For Setting in Masonry: Minimum 3/16 inch thick angles or plates, minimum 4 inches long with hooked ends, welded to back of window frame.
   2. Provide minimum of two anchors per side of window plus one additional anchor for each 18 inches or fraction thereof more than 36 inches in height or width.

C. Glazing Seals: Factory installed; molded EPDM or neoprene compressible gaskets and compression strips.

D. Security Fasteners: Operable only by tools produced by fastener manufacturer or manufacturer's licensee; head style appropriate to installation conditions, strength, and finish of materials being fastened; use countersunk heads wherever possible.
   1. On Steel: Heat-treated alloy steel, with zinc chromate coating at exterior locations and interior wet locations.

E. Bituminous Paint: Cold-applied asbestos-free asphalt mastic, complying with SSPC-Paint 33; 30 mils, 0.030 inch minimum thickness per coat.

2.5 FINISHES

A. Baked Enamel Finish: Cleaned and pretreated; two coat acrylic thermosetting finish, 1.5 to 2 mils thick, applied in accordance with paint manufacturer's recommendations; medium gloss.

B. Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that window openings are ready for installation of windows.

B. Notify Architect if conditions are not suitable for installation of windows; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and drawing details.

B. Install windows in correct orientation (inside/outside or secure/non-secure).

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C. Anchor windows securely in manner so as to achieve performance specified.

D. Separate metal members from concrete and masonry using bituminous paint.

E. Set sill members and sill flashing in continuous bead of sealant.

3.3 CLEANING

A. Clean exposed surfaces promptly after installation without damaging finishes.

B. Remove and replace defective work.

END OF SECTION

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Electromechanical door hardware.

C. Related Sections:
   1. Division 01 Section "General Conditions".
   2. Division 06 Section "Rough Carpentry".
   3. Division 08 Section "Hollow Metal Doors and Frames".
   4. Division 26 Section "Electrical"

D. Codes and References: Comply with the version adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 70 - National Electrical Code.
   4. NFPA 80 - Fire Doors and Windows.
   5. NFPA 101 - Life Safety Code.
   6. NFPA 105 - Installation of Smoke Door Assemblies.
   7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
   1. ANSI/BHMA Certified Product Standards - A156 Series.
   2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
   3. ANSI/UL 294 - Access Control System Units.
   4. UL 305 - Panic Hardware.

1.2 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the

final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.3 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Project Closeout.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
   2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
   3. Review sequence of operation narratives for each unique access controlled opening.
   4. Review and finalize construction schedule and verify availability of materials.
   5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check

Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

A. Hardware shall not have any visible manufacturer names on exposed materials, except cylinders, when the door is in a closed position.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity:
a. Two Hinges: For doors with heights up to 60 inches.
b. Three Hinges: For doors with heights 61 to 90 inches.
c. Four Hinges: For doors with heights 91 to 120 inches.
d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.
5. Manufacturers:
   a. Hager Companies (HA) - BB Series, 5-knuckle.
   b. McKinney (MK) - TA/T4A Series, 5-knuckle.
   c. dormakaba BEST (ST) - F/FBB Series, 5-knuckle.
   d. Approved Equal

2.3 POWER TRANSFER DEVICES

A. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
   1. Provide one each of the following tools as part of the base bid contract:
      a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
      b. McKinney (MK) - Connector Hand Tool: QC-R003.
   2. Manufacturers:
      a. McKinney (MK) - QC-C Series.
      b. Approved Equal

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
   1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
   2. Furnish dust proof strikes for bottom bolts.
   3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
   4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
   5. Manufacturers:

a. Burns Manufacturing (BU).
b. Rockwood (RO).
c. Trimco (TC).
d. Approved Equal

B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
a. Burns Manufacturing (BU).
b. Rockwood (RO).
c. Trimco (TC).
d. Approved Equal

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
1. Manufacturers:
a. Match Existing, Field Verify.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

D. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).
d. Approved Equal

2.7 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
a. ASSA ABLOY ACCENTRA (YA) - 8800FL Series.
b. Corbin Russwin Hardware (RU) - ML2000 Series.
c. Sargent Manufacturing (SA) - 8200 Series.
d. Approved Equal

2.8 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:
a. Strikes for Mortise Locks and Latches: BHMA A156.13.
b. Strikes for Bored Locks and Latches: BHMA A156.2.

c. Strikes for Auxiliary Deadlocks: BHMA A156.36.
d. Dustproof Strikes: BHMA A156.16.

2.9 ELECTRIC STRIKES

A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
1. Manufacturers:
a. HES (HS) - 1500/1600 Series.
b. Approved Equal

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:

a. ASSA ABLOY ACCENTRA (YA) - 4400 Series.
b. Corbin Russwin Hardware (RU) - DC6000 Series.
c. LCN Closers (LC) - 4040 Series.
d. Approved Equal

C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
1. Manufacturers:
a. ASSA ABLOY ACCENTRA (YA) - Unitrol Series.
b. Corbin Russwin Hardware (RU) - Unitrol Series.
c. Norton Rixson (NO) - Unitrol Series.
d. Approved Equal

2.11 ARCHITECTURAL TRIM AND ACCESSORIES

A. Door, Frame and Wall Protective Trim: ANSI/BHMA A156.6, protective products as specified in the hardware sets. Door protection plates shall be not more than 2" less than door width on stop side and 1” less door width on the pull side or on stop side of pairs of doors. Listed manufacturers shall meet all functions and features as specified herein.
1. Provide protective trim with functions and features as follows:
a. Meets ADA requirements for smooth bottom door surfaces.
b. UL Classified options for use on fire-rated doors up to 3 hours.
c. Fabricated from stainless steel, brass, bronze, aluminum, or high-impact plastic.
d. Available in a variety of sizes, finishes, and profiles to suit aesthetic and functional requirements.
e. Designed to protect doors, frames, and adjacent walls from damage due to impact, abrasion, or traffic.
f. Fasteners included; adhesive-backed options available for select models.
g. Ten-year limited warranty.
2. Manufacturers:
a. Burns Manufacturing (BU).
b. Rockwood (RO).
c. Trimco (TC).
d. Approved Equal

2.12 DOOR STOPS AND HOLDERS

A. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
1. Manufacturers:

a. Burns Manufacturing (BU).
b. Rockwood (RO).
c. Trimco (TC).
d. Approved Equal

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:
1. National Guard Products (NG).
2. Pemko (PE).
3. Reese Enterprises, Inc. (RE).
4. Approved Equal

2.14 ELECTRONIC ACCESSORIES

A. Request to Exit Motion Sensor: Passive infrared request to exit (REX) motion sensor designed for detecting exiting through a door from the secure area to a non-secure area.
1. Provide devices with functions and features as follows:
a. Adjustable infrared beam and relock time.
b. UL listed.
c. 12VDC or 24VDC power.
d. Single pole, double throw (SPDT) switch.
2. Manufacturers:

a. Alarm Controls (AK) - SREX Series.
b. Securitron (SU) - XMS2 Series.
c. Approved Equal

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
1. Manufacturers:
a. Securitron (SU) - DPS Series.
b. Approved Equal

C. Intelligent Switching Power Supplies: Provide the least number of power supplies at the appropriate amperage level sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
1. Power supplies shall meet all functions and features as specified herein.
a. UL listed dual voltage 12 or 24 VDC field selectable continuous output.
b. Dedicated fast charger to prolong battery life with low battery cutoff to protect batteries from deep discharge.
c. Enhanced surge immunity for input/output protection
d. Separate, dedicated battery charging circuit to keep locks cooler.
e. Dual-color LED visual notification to prevent applying incorrect voltages to the power supply.
f. Instant auto-switch to battery on AC loss.
g. Expandable up to 16 outputs in the standard enclosure
h. Integrated fire alarm interface to allow main output shutdown or disconnect on a per output basis when using an R8 output module.
i. Network ready and remotely manage locks and connected devices when using an M8 managed output module on network models.
j. Lifetime replacement, no-fault, no questions asked warranty.
2. Manufacturers:
a. Securitron (SU) - AQL Series.
b. Approved Equal

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
   1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
   3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:

1. DJ - Don-Jo
2. MA - Markar
3. MK - McKinney
4. PE - Pemko
5. RO - Rockwood
6. YA - Accentra

Hardware Sets

Set: 1.0

Notes: All existing door hardware to remain.

Set: 2.0

1	Smoke Seal	PK 33 BL17’	PE

Notes:
1. Prepare the existing door and frame to accept the specified hardware.
2. Balance of existing door hardware to remain.

Set: 3.0

1	Push Plate	70C-RKW 4 X 16	US32D	RO
1	Closer	PR4400	689	YA
1	Smoke Seal	PK 33 BL 17’		PE

Notes:
1. Remove Existing Overhead Stop
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 4.0

1	Closer	PR4400	689	YA

Notes:
1. Prepare the existing door and frame to accept the specified hardware.
2. Balance of existing door hardware to remain.

Set: 5.0

2 Continuous Hinge	FM-300 7'0"	630	MA
1 Combination Flush Bolt	2845	US26D	RO
1 Door Coordinator	2672	BLK	RO
2 Closer	4430	689	YA
2 Mounting Bracket	2601AB	BLK	RO
1 Weatherstrip	303 APK 1 x 72" 2 x 84"	630	PE
1 Astragal	351 C 84"		PE
1 Astragal	351 CP 84"		PE
2 Door Bottom Sweep	3452 AV 36"		PE
1 Threshold	171 A 72"		PE

Notes: Salto Lock and Door Position Switches by Security Vendor.

Set: 6.0

1 Continuous Hinge	FM-300 7'0"	630	MA
1 Closer	4430	689	YA
1 Weatherstrip	303 APK 1 x 36" 2 x 84"		PE
1 Door Bottom Sweep	3452 AV 36"		PE
1 Threshold	171 A 36"		PE

Notes: Salto Lock and Door Position Switch by Security Vendor.

Set: 7.0

1 Continuous Hinge	FM-300 7'0"	630	MA
1 Exit Device	7100 x CR627F	630	YA
1 Closer	4430	689	YA
1 Cylinder	CYLINDER AS REQUIRED	626	
1 Weatherstrip	303 APK 1 x 36" 2 x 84"		PE
1 Door Bottom Sweep	3452 AV 36"		PE
1 Threshold Stop Strip	1842 AS 36"		PE
1 Threshold	272 A 36"		PE

Notes: Reuse Existing Electric Strike.

Set: 8.0

1 Exit Device	7100 x CR627F	630	YA
1 Cylinder	CYLINDER AS REQUIRED	626	

Notes:
1. Prepare the existing door and frame to accept the specified hardware.
2. Balance of existing door hardware to remain.

Set: 9.0

Notes: All existing door hardware to remain.

Set: 10.0

3 Door Silencer	608-RKW	Gray	RO

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 12.0

1 Closer	PR4400 689		YA
1 Smoke Seal	PK 33 BL 17’		PE

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 13.0

3 Hinges	TA2714-MCK 1/2 NRP	4 1/2 X 4	26D	MK
1 Closer	PR4400		689	YA
1 Wall Stop	406		US32D	RO
3 Door Silencer	608-RKW		GRAY	RO

Notes: Salto Lock and Door Position Switch by Security Vendor.

Set: 14.0

3 Hinges	TA2314 4 1/2 X 4 1/2	32D	MC
1 Push Plate	70C-RKW 4X16	US32D	RO
1 Pull Plate	111 X 70C	US32D	RO
1 Closer	PR4400	689	YA
1 Wall Stop	406	US32D	RO
3 Door Silencer	608-RKW	GRAY	RO

Set: 15.0

1 Passage	CRCN 8801FL	630	YA
1 Closer	PR4400	689	YA
1 Wall Stop	406	US32D	RO

Notes:
1. Prepare the existing door and frame to accept the specified hardware.
2. Balance of existing door hardware to remain.

Set: 16.0

1 Closer	PR4400	689	YA
1 Smoke Seal	PK 33 BL 17’		PE

Notes:
1. Prepare the existing door and frame to accept the specified hardware.
2. Balance of existing door hardware to remain.

Set: 17.0

2 Continuous Hinge	CFM 83 SLF HD1		PE
2 Extension Flush Bolt	555	US26D	RO
1 Closer	PR4400	689	YA

Notes: Salto Lock and Door Position Switch by Security Vendor.

Set: 18.0

1	Combination Flush Bolt	2845	US26D	RO
1	Door Coor-dinator	2672	BLK	RO
2	Closer	PR4400	689	YA
1	Mounting Bracket	2601AB	BLK	RO
1	Threshold	2005 AV 72”		PE

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 19.0

1 Closer	PR4400	689		YA
2 Door Silencer	608-RKW	Gray		RO

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 20.0

1 Blank Wrap-Around	40-CW	S		DJ

Notes:
1. Prepare the existing door and frame to accept the specified hardware.
2. Balance of existing door hardware to remain.

Set: 21.0

1 Exit Device	7100F	630	YA
1 Closer	PR4400	689	YA
1 Wall Stop	406	US32D	RO

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 22.0

1 Cover Plates	AS REQUIRED	US32D

Notes:
1. Prepare the existing door and frame to accept the specified hardware.
2. Balance of existing door hardware to remain.

Set: 23.0

1 Closer	IF REQUIRED		YA
3 Door Silencer	608-RKW	GRAY	RO

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 24.0

1 Closer	IF REQUIRED	YA
1 Smoke Seal	PK 33 BL 17’	PE

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

Set: 25.0

Notes:
1. Salto Lock and Door Position Switch by Security Vendor.
2. Prepare the existing door and frame to accept the specified hardware.
3. Balance of existing door hardware to remain.

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Plastic sheet glazing units.

D. Window films.

E. Glazing compounds.

1.2 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2026).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2025.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2024, with Editorial Revision (2025).

H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2025.

I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2024.

J. ASTM F1915 - Standard Test Methods for Glazing for Detention Facilities; 2005 (Reapproved 2025).

K. GANA (GM) - GANA Glazing Manual; 2022.

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L. GANA (LGRM) - Laminated Glazing Reference Manual; 2019.

M. GANA (SM) - GANA Sealant Manual; 2008.

N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).

O. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

P. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

Q. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2026.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers and the Architect.
1. Verify glass types and locations are functionally correct for project requirements.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data on Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit samples 12 by 12 inch in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of experience.

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C. Installer Qualifications: Company specializing in performing work of the type specified and with at least ten years experience.

1.6 FIELD CONDITIONS

A. Ambient Conditions: Do not install glazing when ambient temprature is less than 40 degress F.

B. Maintain minimum ambient temperature before, during, and 24 hours after installation of glazing compounds.

1.7 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

B. Polycarbonate Sheet Glazing: Provide a ten (10) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Seismic Loads: Design and size glazing components to withstand seismic loads and sway displacement in accordance with the requirements of ASCE 7
   4. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   5. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

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2. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier seal.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.2 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
2. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
2. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.
3. Ionoplast Interlayer: 0.035 inch thick, minimum.

2.3 INSULATING GLASS UNITS

A. Manufacturers:
1. Vitro Architectural Glass (formerly PPG Glass); Solarban 67
2. Guardian Glass, LLC
3. Pilkington North America Inc
4. Approved equal.

B. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior Non-Secure Doors and Windows.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.30, maximum.
7. Visible Light Transmittance (VLT): 70 percent, minimum.
8. Solar Heat Gain Coefficient (SHGC): 0.39, maximum.
9. Glazing Method: Dry glazing method, gasket glazing.

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2.4 GLAZING UNITS

A. Type G-2 - Monolithic Interior Vision Glazing:
   1. Applications: Interior Non-Secure Doors.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch, nominal.
   5. Glazing Method: Dry glazing method, gasket glazing.
   6. Manufacturers:
      a. Vitro Architectural glass (Formerly PPG).
      b. Guardian Glass, LLC.
      c. McGrory Glass
      d. Approved equal.

B. [Type G-7-Gr1]- Glass-Clad Polycarbonate Security Glazing: Laminated glass and polycarbonate, multi-ply; ASTM C1349.
   1. Applications: Sallyports, Property Storage and Holding Cells
   2. Tint: Clear.
   3. Thickness: [1/2" Lexan with MR Sheet]
   4. Three Ply , clear, extruded Polycarbonate as follows:
      a. 1/8" Polycarbonate sheet with abrasion resistant surface.
      b. Polyurethane interlayer
      c. 1/4" Polycarbonate Sheet
      d. Polyurethane Interlayer
      e. 1/8" Polycarbonate sheet with abrasion resistant surface
   5. Performance Criteria
      a. Forced Entry: ASTM F1233 Class III and ASTM 1915 Grade 2(40 minutes)
   6. Glazing Method: As required to meet performance characteristics.
   7. Manufacturers:
      a. Lexguard MPC-500, Basis of Design
      b. McGrory Glass
      c. Ray-Bar Engineering Corp.
      d. Approved Equal

C. Type G-7-L3 - Glass Clad Polycarbonate Security Glazing
   1. Applications: Exterior Windows
   2. Tint: Clear, Class 1.
   3. Thickness: 1 1/8" Secure-Tem + Poly
   4. Construction: Glass-clad polycarbonate containing an exposed pol;ycarbonate surface with an abrasion resistant coating on the witness "safe" side.
   5. Perfomance Criteria:
      a. Ballistic Level 3
      b. Forced Entry Level 1
   6. Manufacturers:
      a. Level 3 - Secur-Tem + Poly, Basis of Design

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b. McGrory Glass
c. Ray-Bar Engineering Corp.
d. Approved equal.

2.5 PLASTIC SHEET GLAZING UNITS

A. Type P-1 - Polycarbonate Monolithic
1. Applications: Staff Desk
2. Type: Monolithic (single layer solid) sheet.
3. Tint: Clear, transparent.
4. Thickness: 1/2 inch.
5. Performance:
a. Forced Entry
6. Manufacturers:
a. Lexan Margard MR10, Basis of Design.
b. American Acrylic Corp.
c. Amerilux International
d. Approved equal.

2.6 WINDOW FILMS

A. WF-1 : Decorative Film Vinyl type.
1. Application: Locations as indicated on drawings.
2. Pattern: One Way Matte Blackout
3. Installation: As per manufacturer's instructions
4. Thickness Without Liner: 8 mils.
5. Width: 48 inch.
6. Manufacturers:
a. 3M Di-Noc Architectural Finishes, #PS-002AR, Basis of Design
b. Approved Equal.
c. Approved equal.

B. WF-2 :Privacy Window Film Polyester type.
1. Application: Locations as indicated on drawings.
2. Series Type: Mirror.
3. Thickness: 2 mil
4. Visible Light Transmitted: 7%
5. Installation: As per manufacturer's instructions
6. Manufacturer:
a. 3M Privacy Series , Mirror Film, Basis of Design
b. Approved Equal

C. WF-3 :Privacy Window Film Polyester type.
1. Application: Locations as indicated on drawings.
2. Series Type: Frost.
3. Thickness: 4.9 mils

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4. Width: 50 in.
5. Visible Light Transmitted: 86%
6. Installation: As per manufacturer's instructions. Note: Remove existing coating from both sides of glazing before applying new.
7. Manufacturer:
   a. 3M Privacy Series , Fasara Mat Crystal 2 #SH2MACRX2, Basis of Design
   b. Approved Equal

2.7 GLAZING COMPOUNDS

A. Type GC-4 - Polyurethane Sealant: Single component, chemical curing, nonstaining, nonbleeding; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 20 to 35; color as selected by Architect.

B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 25 to 35; black color.

C. Manufacturers:
1. Dow Corning Corporation 795
2. Momentive Performance Materials, Inc.
3. Pecora Corporation
4. Tremco Commercial Sealants & Waterproofing
5. Approved equal.

2.8 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

C. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

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C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

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D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch centers, kept 1/4 inch below sight line.

C. Locate and secure glazing pane using glazers' clips.

D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.6 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.7 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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SECTION 09 05 61 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile
   2. Carpet tile.
   3. Fluid Applied Flooring.
   4. Resilient Athletic Flooring.

B. Preparation of existing concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).

D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

E. Patching compound.

F. Remedial floor coatings.

G. Remedial floor sheet membrane.

1.2 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2024.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

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1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.4 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   3. Manufacturer's installation instructions.
   4. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

C. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Product data for recommended remedial coating.
   7. Submit report to Architect.
   8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

1.5 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

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D. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.

B. Deliver materials in manufacturer's packaging; include installation instructions.

C. Keep materials from freezing.

1.7 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 3500 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

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C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

D. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

PART 3 EXECUTION

3.1 FLOOR FLATNESS

A. Examine floor for flatness with finish floor installers to confirm appropriateness for finishes.
1. Perform examination at least 28 days after concrete placement.
2. Do not rely solely on flatness and levelness readings made at time of concrete placement.
3. Do not exceed manufacturers' requirements.

B. Grind or sand ridges, undulations, projections, and areas of carbonation and scaling, and fill and level expansion joints, cracks, grooves and other irregularities.

3.2 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
1. Preliminary cleaning.
2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that

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adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.

3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.3 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.4 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.5 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

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D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.6 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
   1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
   2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
   3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.7 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.8 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

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3.9 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.10 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

3.11 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

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SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Acoustic insulation.

D. Cementitious backing board.

E. Gypsum board.

F. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants:

1.3 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2020.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2025.

F. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

G. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

H. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2024.

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I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2025.

K. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2024.

L. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

M. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

N. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

O. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2024.

P. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2024.

Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2024.

R. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2024.

S. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019 (Reapproved 2024).

T. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

U. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026.

V. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

W. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.

X. ASTM E413 - Classification for Rating Sound Insulation; 2022.

Y. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

Z. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

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AA. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

BB. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data:
1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, indicating finish color and texture.

E. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

F. Installer's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

B. Store metal products to prevent corrosion.

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PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide completed assemblies with the following characteristics:

C. Grid Suspension Systems: Provide grid suspension systems in accordance with ASTM C840 and GA-216 complying with the following:
1. ICC-ES Evaluation Report No. _____.

D. Fire-Resistance-Rated Assemblies: Provide completed assemblies complying with applicable code.
1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

B. Ceiling Suspension System: System manufactured in accordance with ASTM C635/C635M.

C. Non-structural Framing Accessories:
1. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
   a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
   b. Design assembly at guardrails and reception desks to resist the following forces applied to the top of the assembly and in any direction, without damage or permanent set:
      1) Distributed Loads: 75 pounds per linear foot.
      2) Concentrated Loads: 200 pounds.
   c. Products:
      1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com.
      2) The Steel Network; MidWall: www.steelnetwork.com.
      3) Approved equal.
2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
3. Metal Backing: ASTM A653/A653M G90 galvanized steel.
   a. Provide framing and backing members as indicated or as required to support finishes, fixtures, specialty items, and trim.
   b. In walls, provide backing attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

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c. Where ceiling-mounting is indicated, provide backing and supplementary supports above ceiling, unless other method of support is explicitly indicated.

4. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.

D. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.

2.3 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Glass mat faced gypsum panels, as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
a. Glass mat faced gypsum panels are required wherever board is installed before building is enclosed and conditioned.
3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
4. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
5. Thickness:
a. Vertical Surfaces: 5/8 inch.

B. Impact Resistant Wallboard:
1. Application: As indicated on Drawings.
2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
8. Type: Fire-resistance-rated Type X, UL or WH listed.
9. Thickness: 5/8 inch.
10. Edges: Tapered.
11. Paper-Faced Products:
a. American Gypsum Company; M-Bloc IR Type X: www.americangypsum.com.
b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com.
c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Impact Gypsum Board: www.goldbondbuilding.com.
d. Approved equal.

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C. Backing Board For Tiled Areas:
   1. Application: Surfaces behind tile in wet areas including toilet and locker rooms, and kitchen backsplashes.
   2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
      a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.

D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Ceilings, unless otherwise indicated.
   2. Thickness: 1/2 inch.
   3. Edges: Tapered.

2.4 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness as required for STC.

B. Acoustic Firestop: Moldable acoustic silicone pad, 1/8 inch thick, complying with ASTM E814, ASTM E119, and ASTM C919.
   1. Products:
      a. 3M Fire Protection Products; Fire Barrier Moldable Putty Pads MPP+: www.3m.com/firestop.
      b. Rectorseal, a CSW Industrials Company; Metacaulk Putty and Pads: www.metacaulk.com.
      c. Everkem Diversified Products, Inc; Intumescent Fire-Rated Putty Pads: www.everkemproducts.com.
      d. Hilti, Inc; CP 617 Firestop Putty Pad: www.us.hilti.com.
      e. HoldRite, a Brand of Reliance Worldwide Corporation; HydroFlame Firestop Putty Pad: www.holdrite.com.
      f. Nelson FireStop Products; Firestop Fire Protective Putty (FSP): www.nelsonfirestop.com.
      g. Passive Fire Protection Partners; MP1 - Putty Pads: www.firestop.com.
      h. Specified Technologies Inc; SpecSeal SSP Putty & Putty Pads: www.stifirestop.com.
      i. Tremco Commercial Sealants & Waterproofing; TREMstop MP: www.tremcosealants.com.
      j. Approved equal.

C. Mullion Trim Cap: Sound barrier mullion trim caps of aluminum and sound absorbing foam, capable of accommodating variations in adjacent surfaces.
   1. Fasteners: Concealed.
   2. Sound Transmission: STC 55.
   3. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
   4. Products:
      a. Gordon Incorporated; Mullion-Mate: www.gordon-inc.com.

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b. Approved equal.

D. Adjustable Partition Gap Closures - factory assembled, spring loaded to provide a tght fit for vertical junctures of partitions and mullions and/or window walls.
1. Materials:
a. Aluminum Extrusions: 6063-T5 or T6 temper alloy.
b. Aluminum Sheet: 3000 series alloy.
2. Products:
a. Gordon Incorporated; Mullion Mate Plus, Basis of Design
b. Approved Equal

E. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Types: As indicated on drawings or required for finished appearance.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
2. Joint Compound: Drying type, vinyl-based, ready-mixed.

G. Finishing Compound: Surface coat and primer, takes the place of skim coating.

H. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

I. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

J. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

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1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

C. Acoustic Firestop: Wrap pads around electrical boxes, cutting as required to fit around wires, before concealing or enclosing.

3.3 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

F. Replace gypsum board that directly or indirectly has been damaged by exposure to moisture or mold.

3.4 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
1. Not more than 30 feet apart on walls, soffits, and ceilings over 50 feet long or more than 900 square feet in area.
2. Where a control joint occurs in a fire or an acoustically rated assembly, provide gypsum blocking behind the joint.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.5 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

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B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
   5. Level 0: Temporary partitions.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.6 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

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SECTION 09 22 29 – SECURITY CEILING REINFORCEMENT

PART 1 GENERAL

1.1 SUMMARY

A. The work in this section shall include furnishing and installing ceiling reinforcement above gypsum board ceilings where indicated.

B. Work includes:
1. Security Steel Mesh Reinforcement
2. Attachment Hardware
3. Supplemental Framing
4. Coordination with ceiling mounted devices and penetrations

1.2 RELATED SECTIONS:

A. Section 09 21 16 Gypsum Board Assemblies

1.3 PERFORMANCE REQUIREMENTS

A. Provide continuous ceiling reinforcement to resist unauthorized penetration, concealment of contraband, and access to overhead spaces.

B. Reinforcement shall remain securely attached when subjected to concentrated loads applied between framing members.

C. Provide complete system capable of resisting tampering and vandalism.

1.4 SUBMITTALS:

A. PRODUCT DATA:
1. Provide Manufacturer's catalog cuts with printed specifications and installation instructions.

B. SHOP DRAWINGS:
1. Shop Drawings showing mesh layout, framing supports, penetrations and attachment methods.

C. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.1 SECURITY MESH

A. Material:
1. Welded steel wire mesh or expanded steel security mesh.

B. Welded Wire Mesh:
1. Wire Diameter: Minimum 0.192 inch (6 gauge)
2. Grid Opening: Maximum 2 inches by 2 inches
3. Finish: Hot-Dip galvanized after fabrication

C. Manufacturers
1. C.E. Shepard Company security mesh
2. Detention Security Systems security ceiling mesh
3. Approved Equal

2.2 SUPPORT FRAMING

A. Cold Formed Steel Framing
1. Minimum 16 gauge
2. ASTM C645

B. Supplemental framing as required to support mesh.

2.3 FASTENERS

A. Tamper resistant steel fasteners

B. Security screws utilizing pin-in-Torx, spanner, or approved security drive.

C. Galvanized steel clips and ties.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify framing is complete and capable of supporting security reinforcement.

3.2 INSTALLATION

A. Secure mesh directly to structural framing or supplemental steel supports.

B. Maximum support spacing:
1. 24 inches on center unless otherwise indicated by manufacturer

C. Lap Mesh Panels

1. Minimum 2 inches
2. Secure laps at maximum 6 inches on center

D. Provide continuous reinforcement around:
1. Light fixtures
2. Air devices
3. Speakers
4. Security Devices
5. Access Openings

E. Frame all penetrations with steel supports

F. Do not leave openings larger than specified mesh size.

3.3 FIELD QUALITY CONTROL

A. Inspect all attachments before installation of gypsum board

B. Repair loose, damaged, or improperly secured mesh.

C. Replace damaged materials.

3.4 PROTECTION

A. Maintain reinforcement intact until ceiling assembly is completed.

B. Protect galvanized finish from damage.

END OF SECTION 09 22 29

SECTION 09 51 00 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2020.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 4 by 4 inch in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

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F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.5 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com/ceilings-and-walls.
   3. USG Corporation: www.usg.com.
   4. Approved Equal

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Approved Equal

2.2 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A. Type B Form B2, Pattern E

B. Acoustical Panels (APC-1): Fiberglass with acoustical transparent membrane characteristics:
   1. Size: 24 by 48 inches.
   2. Thickness: 3/4 inches.
   3. Composition: Fiberglass.
   4. Edge: Square.
   5. NRC: 0.90
   6. AC: 180
   7. Light Reflectance: 0.88
   8. Surface Color: White.
   9. Suspension System: Exposed grid Type W.
   10. Products:
      a. Armstrong Optima #3151
      b. CertainTeed Baroque,
      c. USG
      d. Approved equal.

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2.3 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

B. Exposed Steel Suspension System Type W: Formed steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 15/16 inch wide face.
2. Construction: Double web.
3. Finish: White painted.

2.4 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.

D. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
1. Finish: Baked enamel.
2. Color: White.
3. Products:
a. Armstrong World Industries, Inc; Axiom: www.armstrong.com.
b. CertainTeed Corporation; Cloud Permeter Trim: www.certainteed.com.
c. USG Corporation; Compasso Suspension Trim: www.usg.com/ceilings.
d. Approved equal.

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

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C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.3 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.

D. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
1. Cut to fit irregular grid and perimeter edge trim.
2. Make field cut edges of same profile as factory edges.
3. Double cut and field paint exposed reveal edges.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

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G. Install hold-down clips on panels within 20 ft of an exterior door.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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09 57 53 - ACOUSTICAL SECURITY CEILINGS

PART 1 – GENERAL

1.1 SECTION INCLUDES:

A. This specification covers the material, installation, and related requirements for the Metal Plank Ceiling System – including all necessary Acoustical Insulation, Suspension Systems, and Fasteners.

1.2 RELATED DOCUMENTS/SECTIONS:

A. Drawings and general provisions of Contract.

B. Division 01 Specification sections apply to the work of this Section.

C. Finish Schedule or Finish Legend apply to work of this Section.

1.3 REFERENCES:

A. GENERAL
1. Comply with applicable requirements of the following, except where more stringent requirements are indicated by building codes.

B. ASTM (American Society for Testing and Materials)
1. ASTM C636, Recommended Practice for Installation of Metal Suspension System for Acoustical Tile and Lay-In Panels.

C. CISCA Ceiling Systems Installation Handbook.

1.4 DESIGN/PERFORMANCE REQUIREMENTS:

A. All components of the Metal Plank Acoustical Security Ceiling System shall be provided by one (1) Manufacturer to ensure single source responsibility and quality control.

1.5 SUBMITTALS:

A. Submission must be made within ten (10) working days of the General Contract Award to avoid project delay.
1. After award of contract, standard Shop Drawings shall be submitted and approved prior to fabrication of the Metal Planks or their structural supports.

B. Product Data: Submit Manufacturer's:
1. Product data
2. Installation Instructions

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C. Shop Drawings: Submit Shop Drawings for fabrication and installation of Metal Plank Acoustical Security Ceiling System.

D. Samples:
1. A 1’ x 1’ assembled sample of each Ceiling Panel and its Suspension System shall be submitted for approval.

E. Closeout Submittals
1. Provide Manufacturer’s Cleaning and Maintenance Instructions
2. Warranty Documents
3. Manufacturer’s certification of compliance with the acoustical performance required as described in this specification.

1.6 QUALITY ASSURANCE:

A. Manufacturers’ Qualifications: Firm with manufacturing and delivery capacity required for the project, shall have successfully completed at least ten (10) projects within the past five (5) years, utilizing systems, materials, and techniques as herein specified.

B. Fabricator must own and operate its own manufacturing facilities for all metal components. Systems consisting of components from a variety of Manufacturers will not be considered or accepted.

C. Manufacturer/Fabricator must own and operate its own painting and finishing facility to assure single source responsibility and quality control.

D. Installer’s Qualifications: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to the Manufacturer of the System.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver Panels and all System Hardware to the job site in Manufacturer’s original packaging, unopened and undamaged, just prior to installation.

B. Avoid warpage and damage by storing Panels and all System Hardware above floor, flat and in a dry, humidity and temperature controlled interior location.

C. Follow Manufacturer’s instructions and exercise care during off loading, handling and installation to avoid damage and marring of finishes.

1.8 SEQUENCING:

A. Manufacturer’s Production Schedule: Sub-contract for the work of this section shall be planned to allow sufficient time for Manufacturer’s production and delivery scheduling.

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1.9 WARRANTY:

A. Furnish Manufacturer's:
1. Warranty that materials furnished will perform as specified for a period of not less than one (1) year from date of material shipment when installed in accordance with Manufacturer’s recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

B. Gordon, Inc., Cel-Line® Metal Plank Acoustical Security Ceiling System, Inc., Basis of Design

C. Armstrong

D. Trussbilt

E. Approved Equal

2.2 PRODUCT CONSTRUCTION:

A. Product Components:
1. Metal Plank Ceilings: The Metal Plank System is to be fabricated and installed in accordance with the Manufacturer’s approved Shop Drawings. Metal Planks shall be factory formed from 12 Gauge perforated (non-perforated) galvannealed (minimum A60) steel as indicated on the Shop Drawings. Planks shall be formed 24’’ wide in lengths of up to 12’-0’’ as shown on Reflected Ceiling Plans. Vertical legs of Metal Planks are to be factory formed so that Panels overlap tightly to provide positive self-alignment with adjacent Panels.
2. Metal Plank Suspension: Perimeter Angles and Main Tee Runners shall be factory fabricated from 12 Gauge factory finished galvannealed (minimum A60) steel. Angles and Tees shall be factory pre-punched to receive Fasteners. Angles shall be fastened to all abutting vertical surfaces through the use of drilled in anchors or other approved Fasteners at a minimum of 16’’ O.C. Tee sections shall be suspended by 14 Gauge 1-1/2’’ x 1-1/2’’ galvanized slotted Angles bolted to Main Tees at minimum of 5’-0’’ O.C., hung from structural members or drilled in anchors of appropriate type and dimension as approved by the Architect. Panels shall be securely fastened to all Angles and Tee sections with (steel rivets) (Torx® security fasteners) of appropriate dimension (painted to match Panels) minimum 6’’ O.C. [or through the use of concealed Hold Down Angle mechanically fastened to abutting vertical surfaces].
a. Acoustical Material: The inside surface of all perforated Ceiling Panels shall be covered with Class A fiberglass Insulation wrapped in black Fire-Retardant Poly. Insulation shall be of sufficient thickness and density to provide the acoustical requirements as outlined herein.

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b. Lights and Air: All light and air units are to be system compatible and sized so as to fit into and trim off full module opening in Ceiling System and shall be independently supported from above by installing trade.
c. Access Doors: All security Access Doors to be installed in the Metal Security Ceiling System shall be supplied by the Metal Security Ceiling System Manufacturer in quantities indicated on the Architectural Drawings or as approved by the Architect. Access Doors shall have the following characteristics:
   1) Size: 24'' x 24'', which fits an opening of 23-3/4'' x 23-3/4''
   2) Door: 16 Gauge steel
   3) Frame: 16 Gauge steel
   4) Hinge: Full-length semi-concealed piano hinge that opens 180 degrees
   5) Anchors: Heavy steel, welded to frame
   6) Lock: Theft-proof, security bolt, with key
   7) Finish: Factory white polyester powder coated paint finish
d. Fasteners: All exposed Fasteners shall be tamper-proof and shall be a minimum No. 12 size. Fasteners for securing the Wall Molding to the wall are to be selected and furnished by the Contractor and approved by the Architect/Engineer.

B. Product Performance:
1. Accessibility: Suspended Metal Plank Ceiling Systems shall be designed and installed to resist access to the plenum area. System compatible hinged locking downward accessible Doors are to be provided in locations indicated on architectural Reflected Ceiling Plans. Access Doors are to be sized so as to fit into and trim off full module opening in Ceiling System.
2. Acoustical Requirements: The perforated Ceiling Systems shall provide a Noise Reduction Coefficient (NRC) of no less than 0.80 when tested in accordance with ASTM C423-84a in an E- 400 mounting as defined in ASTM E795-83.

2.3 FINISHES:

A. Metal Planks and Related Suspension:
1. The Metal Planks shall have a factory-applied white super-durable polyester powder coating finish. Finish to be applied after perforation (if applicable) to ensure coating of perforated holes. Panels shall be coated to a minimum thickness of 2.0 mils on the finish side.
2. Prior to painting, galvannealed steel surfaces shall be cleaned, rinsed, and properly treated to receive the powder coating finish.
3. Finish to achieve the following performance characteristics:
   a. Salt Spray per ASTM B-117 – 1,000 hours PASS at less than 1/8'' from score.
   b. Humidity Resistance per ASTM D-2247 – 1,000 hours PASS at less than 1/8'' from score.

2.4 FABRICATION:

A. The Ceiling Contractor shall verify all dimensions, elevations, and job site conditions before fabrication commences.

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PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examination of Surfaces: Installer must examine conditions under which work is to be performed and must notify Contractor in writing of unsatisfactory conditions.

B. Verify that field measurements and block-out dimensions are as shown on Shop Drawings.

3.2 PREPARATION:

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the Manufacturer to achieve the best result for the project conditions.

3.3 INSTALLATION:

A. General: Comply with Manufacturer's printed instructions, governing regulations for Seismic Codes, Local Building Codes, and the Ceiling & Interior Systems Construction Association Standards applicable to work.

B. The Metal Security Ceiling System shall be installed in accordance with ASTM C636 and CISCA guidelines, in layouts as reflected on the approved Shop Drawings, all in compliance with the Manufacturer's Installation Instructions.
   1. The Suspension System and Wall Moldings shall be installed plumb and level.
   2. Start installation of Metal Plank at location as shown on Reflected Ceiling Plans. Slide Metal Plank along Perimeter Angle to create a ship lapped joint between adjoining Panels. Ensure self-aligning legs overlap each other. *Side stitch Panels together along ship lapped Panel joints with self-tapping fasteners per approved Shop Drawings or at a minimum of 24'' O.C.*
   3. In order to achieve secure and tightly engaged Panel joint details, Panels must be installed progressively from the start Panel through the closure Panel. Except for the openings for light, air, fire protection, or access shown on the Reflected Ceiling Plans, all openings or cut outs required in the Ceiling Planks shall be field cut by the trades requiring the openings.

3.4 CLEANING:

A. Follow Manufacturer's cleaning instructions for specified finish.

3.5 PROTECTION:

A. Procedures: Care should be taken during the remainder of construction to protect the Metal Security Ceiling System from damage.

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B. Damage to Finished Work: Finished units of the Metal Security Ceiling System shall be without damage. Damage shall be repaired by the Contractor at the expense of the party damaging the material, as in accordance with the contract requirements.

END OF SECTION

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SECTION 09 65 00 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

B. ASTM F1700 - Standard Specification for Solid Vinyl Floor in Modular Format such as Tile(s) or Plank(s); 2025.

C. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021 (Reapproved 2025).

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.

D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Extra Flooring Material: Quantity equivalent to 5 percent of each type and color.

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2. Extra Wall Base: Quantity equivalent to 5 percent of each type and color.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

1.6 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1 TILE FLOORING

A. Vinyl Tile - Type LVT: Printed film type, with transparent or translucent wear layer.
1. Manufacturers:
   a. Tarkett North America, Contour Series,. Color Weave, Basis of Design
   b. Shaw Contract
   c. Mannington Commercial
   d. Approved equal.
2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
4. Wear Layer Thickness: 32 mil (o.8mm).
5. Total Thickness: .120 inch.
6. Size: As indicated on drawings
7. Color: As indicated on drawings.

2.2 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; Style B, Cove.
1. Manufacturers:
   a. Roppe Corporation; Pinnacle Rubber Wall Base, Basis of Design:
   b. Approved equal.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
3. Height: 4 inch.

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4. Thickness: 0.125 inch.
5. Finish: As indicated on drawings.
6. Length: Roll.
7. Color: As indicated on drawings.

2.3 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Moldings, Transition and Edge Strips: Metal.

D. Filler for Coved Base: Plastic.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
1. Test in accordance with Section 09 05 61.
2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.2 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.3 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

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C. Adhesive-Applied Installation:
   1. Fit joints and butt seams tightly.
   2. Set flooring in place, press with heavy roller to attain full adhesion.

D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.

E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

H. Install flooring in recessed floor access covers, maintaining floor pattern.

3.4 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to basket weave pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

D. Install loose-laid tile, fit interlocking edges tightly.

E. Install plank tile with a random offset of at least 6 inches from adjacent rows.

3.5 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.6 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean, seal, and wax in accordance with manufacturer's written instructions.

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3.7 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

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09 65 66 – RESILIENT ATHLETIC FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Supply and installation of the indoor resilient multipurpose surfacing

B. Application of the game lines

C. References for the construction and preparation of concrete slabs to receive resilient flooring.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's promotional brochures, specifications and installation instructions

B. Samples:
   1. Submit for selection and approval three (3) sets of the indoor resilient multipurpose surfacing, manufacturer's brochures, samples or sample boards of all of the available colors, textures and styles.
   2. Submit color samples of all the available game line paint colors for selection and approval.

C. Closeout Submittals:
   1. Submit three (3) copies of the indoor resilient multipurpose surfacing and manufacturer's maintenance instructions.
   2. Submit three (3) copies of the material and installation warranties as specified.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. The indoor resilient multipurpose surfacing shall have been actively marketed for a minimum of ten (10) years.
   2. The indoor resilient multipurpose surfacing shall be manufactured in an ISO 9001 certified plant.
   3. The indoor resilient multipurpose surfacing supplier shall be an established firm, experienced in the field, and appointed as a distributor by the manufacturer of the indoor resilient multipurpose surfacing.
   4. The installer of the indoor resilient multipurpose surfacing shall have a minimum of five (5) years of experience in the field installing indoor resilient multipurpose surfacing and have worked on at least five (5) projects of similar size, type and complexity.

B. Certifications:
   1. Installer to submit the indoor resilient athletic surfacing manufacturer's certification attesting that they are an approved installer of the indoor resilient multipurpose surfacing.

2. The indoor resilient multipurpose surfacing manufacturer to submit official ISO 9001 certification for the facility in which the indoor resilient multipurpose surfacing is manufactured.

C. Testing:
1. Tests shall be relative for multi-purpose use with certificates from independent testing resources to be made available upon request. Test results shall be no more than 5 years old and performed according to ASTM standard testing procedures.

D. Certifications:
1. Installer to submit the indoor resilient athletic surfacing manufacturer's or distributor's certification attesting that they are an approved installer of the indoor resilient multipurpose surfacing.

E. Testing:
1. Tests shall be relative for multi-purpose use with certificates from independent testing resources to be made available upon request. Test results shall be no more than 5 years old and performed according to ASTM F2772 standard testing procedures for force reduction, ball bounce, vertical deformation, and surface finish effect.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Material shall not be delivered until all related work is in place and finished and/or proper storage facilities and conditions can be provided and guaranteed stable according to manufacturer's recommendations.

B. Storage:
1. Store the material in a secure, clean and dry location. Maintain temperature between 55° and 85° Fahrenheit.

1.5 PROJECT/SITE CONDITIONS

A. It is the responsibility of the general contractor to maintain project/site conditions acceptable for the installation of the indoor resilient multipurpose flooring.

B. The area in which the indoor resilient multipurpose surfacing will be installed shall be dry and weather tight. Permanent heat, light and ventilation shall be installed and operable.

C. All other trades shall have completed their work prior to the installation of the resilient athletic flooring. The general contractor shall maintain a secure and clean working environment before, during and after the installation. Suspension of other trades' work may be authorized providing their work will not damage the new flooring.

D. Maintain a stable room temperature of at least 65°F for a minimum of one (1) week prior to, during, and thereafter installation.

E. An effective low-permeance vapor barrier is placed directly beneath the concrete subfloor. For "on" or "below grade" installations, it is recommended to provide a permanent vapor barrier resistant to long term hydrostatic pressure/moisture exposure. Protrusions should be sealed to prevent moisture migration into the slab. Moisture should not be allowed to enter the slab after the completed construction.

F. Concrete subfloor surface pH level within the 7 to 10 range dependent upon installation type.

G. Concrete subfloor should be no greater than 1/8" within a 10 ft diameter. This tolerance can be measured in accordance with ASTM E1155. A specified (F_F) of 50 and an (F_L) of 30 should reach this degree of floor flatness and floor level. There is no numerical correlation between F numbers and the deviation from the straight edge, however the above specified numbers should achieve a flat floor with minimal deviation in the slab. Reference ACI 117 and ACI 302.1R. The general contractor should provide a certificate of compliance with the above recommendations.

H. Concrete subfloor must be clean and free of all foreign materials or objects including, but not limited to, curing compounds and sealers.

I. Fill cracks, grooves, voids, depressions, and other minor imperfections with Ardex (or equal) cement-based patching/leveling compounds. Follow the manufacturer's directions. Moveable joints must be treated utilizing specific transitioning joint devices depending upon the architect's recommendations. Follow current ASTM F710 guidelines for the preparation of concrete slabs to receive resilient flooring.

J. Refer to ACI 302.2R "Guidelines for Concrete Slabs that Receive Moisture- Sensitive Flooring Materials" for concrete design and construction.

K. Concrete slab shall be fortified with continual steel reinforcement. Fiber reinforcement alone shall not be considered adequate fortification.

1.6 WARRANTY

A. Materials:
   1. The indoor resilient athletic surfacing shall be covered by the manufacturer against product defects for 30 years and moisture warranty for 10 years. The manufacturer of the indoor resilient multipurpose surfacing must provide this warranty upon request.

B. Installation:
   1. The installation of the indoor resilient multipurpose surfacing shall be covered against poor workmanship and faulty installation by a two (2) year written, limited warranty provided by the contractor performing/overseeing the installation.

1.7 ADDITIONAL MATERIALS

A. Furnish to the owner additional materials containing a total of at least 1% of each different color or design of the indoor resilient athletic surfacing used on the project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Field Turf, Polyturf Plus Pad and Pour, Basis of Design

B. Approved Equal

2.2 MATERIALS.

A. Flooring System:

1. Polyturf Plus 7+2 (9 mm total thickness) consists of a recycled resilient sheet force reduction layer integrated with seamless, liquid applied, and self-leveling 2 mm polyurethane topcoat.

2. A durable protective color coat shall be applied to a thickness of approximately 7 mils. The finished product shall be a seamless surface heterogeneous resilient multipurpose synthetic flooring system. System shall comply with the following criteria. Colors to be selected from manufacturer's standard range.

Properties	Standards	PolyTurf Plus Pad & Pour Base Mat + Wear Coat +Top Coat
Base Mat Properties		
Width		59"
Length		82 lin. ft
Weight		1.2 lb/sq ft
Density	ASTM D297	.67 min (g/cm?)
Tensile Strength	ASTM D412	88 psi (Die Cast C)
Elongation	ASTM D412	48.5% (Die Cast C)
Compression	ASTM F36	@50 psi @100 psi @200 psi 87% 91% 91%
Tear Strength	ASTM D624	30 PPI Die C
Flexibility	ASTM F147	0-1
Compression Set B	ASTM D395	37% (25% deflection 158°F/22hrs)
Compression Set B	ASTM D395	26% (50% deflection 158°F/22hrs)
2mm Wear Coat Properties		
Shore Hardness	Shore A	80
Tensile Strength	ASTM D412	3200 psi
Elongation	ASTM D412	340%
Tear Strength	ASTM D624	360 PLI
Misc Technical		
Fire Classification	ASTM E648	Class 2
Environmental Certification	GreenGuard	GreenGuard Plus Certified
Sports Characteristics		
Overall Thickness		7+2 (9 mm)
Shock Absorption	ASTM F2772	Class 1
Ball Bounce	ASTM F2772	>90%
Vertical Deformation	ASTM F2772	Passed
Surface Finish Effect	ASTM F2772	Passed
Installation with Multi-Poxy	92% Per ASTM F2170	

3. Game Line Paint:
As approved by the indoor resilient athletic surfacing manufacturer. Colors are to be selected from the manufacturer's standard range.

B. Tarkolay – A high quality low permeance slip sheet vapor retarder designed to separate the installed system from the substrate below. Tarkolay as manufactured by FieldTurf USA, Inc. can be used below, on, or above grade substrates that experience elevated moisture conditions. Moisture tolerances shall not exceed 100% RH per ASTM F2170.

1. Physical properties of the vapor retarder shall conform to the following minimums:

Width	…….	6'6" (2 m)
Length	…….	147'7"' (45 m) approx.
Total Thickness	…….	1.3 mm
Dimensional Stability	PASSED	.01% (EN 1434)
Permeance	Excellent	<0.20 (ASTM E96

PART 3 EXECUTION

3.1 EXAMINATION

A. It is the responsibility of the general contractor to ensure that project/site conditions are acceptable for the installation of the indoor resilient athletic flooring.

B. Verify that the area in which the indoor resilient athletic surfacing will be installed is dry and weather tight. Verify that permanent heat, light and ventilation is installed and operable.

C. Verify that all other work that could cause damage, dirt and dust or interrupt the normal pace of the indoor resilient athletic flooring installation is completed or suspended.

D. Verify that there is a stable room temperature of at least 65°F.

E. Verify that there are no foreign materials or objects on the subfloor and that the subfloor is clean and ready for installation.

F. Moisture content less than 98 % RH when tested per ASTM F2170. Follow manufacturer installation recommendations.

G. Do not average the results of the tests. Report all field test results in writing to the General Contractor, Architect, and End User prior to installation.

H. Verify that the concrete subfloor surface pH level is within the 7 - 10 range.

I. Document the results indicating the slab is within manufacturer's tolerances for slab deviation.

3.2 PREPARATION OF SURFACES

A. Sand the entire surface of the concrete slab.

B. Sweep the concrete slab so as to remove all dirt and dust. If a sweeping compound is to be used it must be a sweeping compound that does not contain oil or other items that may inhibit the adhesive bond.

C. Slab must be dust free. In the event that dust impairs adhesive bond, priming the slab prior to application of adhesive may be necessary. Follow installation guidelines.

3.3 INSTALLATION

A. The installation area shall be closed to all traffic and activity for a period to be set by the indoor resilient athletic surfacing installer. The indoor resilient athletic surfacing installation shall not begin until the installer is familiar with the existing conditions.

B. All necessary precautions should be taken to minimize noise, smell, dust, the use of hazardous materials, and any other items that may inconvenience others.

C. Install the indoor resilient athletic surfacing in strict accordance with the indoor resilient athletic surfacing manufacturer's written instructions.

D. Paint game lines using approved game line paint primer and game line paint in strict accordance with the game line paint manufacturer's instructions.

E. Install appropriate threshold plates or transition strips where necessary.

F. Use only approved adhesive as recommended by the manufacturer.

3.4 CLEANING

A. Remove all unused materials, tools, and equipment and dispose of any debris properly. Clean the indoor resilient athletic surfacing in accordance with the manufacturer's instructions.

3.5 PROTECTION

A. If required, protect the indoor resilient athletic surfacing from damage using coverings approved by the manufacturer until acceptance of work by the customer or their authorized representative.

3.6 RELATED STANDARDS AND GUIDELINES

A. ASTM F2170 "Standard Test Method for Determining Relative Humidity In Concrete Floor Slabs Using In-Situ Probes"

B. ASTM F710 “Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring”

C. ACI 302.2R-06 “Guideline for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials”

END OF SECTION

SECTION 09 67 00 FLUID APPLIED FLOORING AND WALLS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resinous flooring and wall systems with all necessary accessories for complete installation.
   2. Preparation of flooring substrate.
   3. Protection of adjacent materials and surfaces.

B. Related Sections:
   1. Cast-in-Place Concrete: Section 03 30 00.
   2. Concrete sub-floor to be level (maximum variation not to exceed ¼ inch in 10 feet) and to have a steel troweled finish. No curing agents or other additives which could prevent bonding should be used unless the mechanical surface preparation method used completely removes any curing agent residue or sealer.
   3. Slabs on grade must have an efficient puncture resistant vapor barrier a minimum thickness of 10 mils placed directly under the slab.
   4. Sealants: Section 07 92 00.
   5. Gypsum Drywall: Section 09 21 16.
   6. Adjacent floor finishes: Division 09.

1.2 DEFINITIONS

A. Fluid Applied Urethane Resin Cement Flooring specified under this section is referenced on the drawings as Urecon Chip-100 and FlowResin Flowfresh SRX. Key High Build Wall system.

B. Fluid Applied fiber reinforced epoxy wall coating system specified under this section is referenced on the drawings as Key 544-F High Build Wall System.

1.3 SYSTEM DESCRIPTION

A. Kitchen floor system (FAF-2) shall be 3/16” urethane cement surfacing with broadcast colored flakes and epoxy grout coat to form a cleanable surface. Surface topcoat(s) shall be as specified in Section 2.01.A.

B. Shower floor system (FAF-1) shall be 1/4” – 5/16” slurry broadcast, anti-slip, and antimicrobial treated cementitious urethane flooring system.

C. Shower wall system (FAW-1) shall be a high build epoxy wall coating with urethane topcoat.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product literature, technical specifications, applications instructions, product storage and handling requirements, and similar data for each product specified below as required to demonstrate compliance with specified requirements and provide complete application information.

B. Samples: Submit a minimum of three standard size cured samples of flooring and wall system indicating color and finish properties. Approved samples will be used during installation for product match.

C. Certified Test: Submit two copies of supplier's/manufacturer's written certification that flooring and wall system meets or exceeds required properties.

D. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions of special handling instructions required to comply with the Occupational Safety and Health Act.

E. Shop Drawings: Shop Drawings shall be furnished showing installation of cove base, termination details and details at floor material transitions and where adjoining equipment.
   1. Locate and provide written detailing of treatment for all types of concrete substrate joints and repair of cracks required for flooring in area of installation.

F. Maintenance Instructions: Submit current copies of the flooring and wall manufacturer's printed recommendations on maintenance methods and products. Submit in accordance with Section 01 70 00 – Project Closeout.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and finish or sealing coats, from a single manufacturer. Provide secondary materials including underlayment, joint sealant, and repair materials only of type and from source recommended by manufacturer of primary materials.

B. Installation shall be performed by an applicator with minimum 10 years experience in work of similar nature and scope. Installer must be approved by the manufacturer of the floor surfacing materials. The general contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

C. Installer to keep daily log of the date of installation, room number, type, color, and method of application of product being installed. Log must be available for inspection by the Architect upon request.

D. Provide a full-thickness, portable finished mock-up sample measuring 2 ft x 2 ft minimum to demonstrate texture, color, thickness, chemical resistance, cleanability, and other features of

the resinous floor and wall. Simulate finished lighting conditions for review of in-place field sample.

1. If the initial control sample is unacceptable, make adjustments to comply with requirements until acceptable and approved.
2. The approved mock-up to be the standard of quality for installed work.
3. Unacceptable installed work to be removed and replaced until acceptable. Aesthetically unacceptable but well bonded work may be overlaid or recoated if thickness clearances permit.

1.6 PROJECT CONDITIONS

A. Maintain the ambient room and the floor and wall temperatures at 60 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and 24 hours after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.

B. Dew Point: Substrate temperature must be minimum of 5 degrees above dew point prior to, during or up to 24 hours after application of flooring and wall system.

C. Illumination: Apply flooring and wall system only where a minimum of 30 footcandles exist when measured 3 feet from surface.

D. Advise other trades of fixtures and fittings not to be installed until flooring and wall are cured and protected.

1.7 PROTECTION

A. Protect adjacent surfaces not scheduled to receive the flooring and wall by masking, or by other means, to maintain these surfaces free of the flooring or wall material.

B. Provide adequate ventilation and fire protection at all mixing and placing operations. Prohibit smoking or use of spark or flame producing devices within 50 feet of any mixing or placing operation.

C. Provide polyethylene or rubber gloves or protective creams for all workmen engaged in applying products.

1.8 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered to project site in original manufacturer's sealed containers including type of material, batch numbers, date of manufacture, and pertinent labels intact and legible.

B. Store materials in dry protected area at a temperature between 60° F to 80° F.

C. Follow all manufacturer's specific instructions and prudent safety practices for storage and handling.

1.9 WARRANTY

A. Contractor to guarantee work under this Section to be free from defects of material and installation for the duration of the warranty period. Defects occurring during warranty period shall be repaired, in a manner satisfactory to the Owner and the Architect, at no additional cost to the Owner.
   1. Standard Warranty Period: One (1) Year.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

B. Manufacturer:

   1. Key Resin Company; Basis of Design:
      a. Urecon Chip-100 (FAF-2 Kitchen Floor), Basis of Design
      b. Key544-F High Build Wall Coating systems (FAW-1 Shower Walls), Basis of Design
      c. Flow Resin, Flowfresh SRX, (FAF-1 Shower Floors) Basis of Design
      d. Approved Equal

C. System description: Heavy duty, three-component urethane resin modified cementitious topping broadcasted with silica aggregate, grouted with a 100% solids epoxy with broadcasted colored flakes, sealed with a clear epoxy, and topcoated with a urethane or polyaspartic.

D. Alternative manufacturers must have as a minimum the standards set forth in this specification and must be preapproved in accordance with project requirements.

2.2 MATERIALS

A. Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, urethane cement and epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base at perimeter unless noted otherwise.
   1. FAF-1 Shower Floors: Basis of Design Product Flow Resin Flowfresh SRX, 1/4" – 5/16”
   2. FAF-2 Kitchen Floors: Basis of Design Product: Key Resin Company – Key Urecon Chip-100, 3/16”-1/4” Urethane Cement Decorative Resinous Flooring System
   3. Approved Equal

B. FAF-2 Body Coat: Key Urecon Chop 100, a complete three component unit consisting of reactive urethane ingredients and selected fillers and aggregates.
   1. Broadcast Aggregates: Silica sand or colored quartz (ceramic coated silica)
   2. Broadcast Coat: a two-component 100% solids pigmented epoxy
      a. Broadcast Aggregates: PVA colored chips (flakes) to match architect's sample
   3. Grout Coat: Key #511 or Key #514, a two-component 100% solids clear epoxy floor coating
   4. Topcoat: Key #467, a two component high solids urethane or Key #470/#471, a two component polyaspartic.
      a. Include fine or medium non-skid additive at manufacturer's recommended dosage to achieve desired non-slip texture.

   5. Finish: Color to match Architect's sample as chosen from standard color chart.
   6. Provide slip-resistant, cleanable orange peel textured finish. Texture to match approved mock-up.
   7. Provide finish matching approved sample. Multiple non-skid textures required based on room functions.
      a. Provide 6" inch integral coved base where required.

C. FAF-1: Flow Resin Flowfresh SRX, or approved equal, a seamless, heavy duty polyurethane cementitious resin flooring system consisting of:
   1. Moisture tolerant polyurethane primer where required
   2. Polyurethane cementitious body coat
   3. Broadcast aggregate or texture system
   4. Protective Dealing coat
   5. Finish: Color to match Architect's sample as chosen from standard color chart.
   6. Provide 6" inch integral coved base where required.

2.3 MATERIALS - WALL

A. FAW-1 Resinous Wall: Abrasion-, impact- and chemical-resistant wall coating to produce a seamless wall and integral cove base at perimeter unless noted otherwise.
   1. Basis of Design Product: Key Resin Company – Key 544-F High Build Wall Coating System with #446 water based urethane topcoat.
   2. Approved Equal

B. System Characteristics:
   1. Color and Pattern: As selected by Architect from manufacturer's full range of standard colors.
   2. Overall System Thickness: Minimum 15-20 mils.

C. Primer: Type recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated.

D. Body Coat:
   1. Resin: Epoxy

2. Type: Key #544 Chemically Resistant Wall Epoxy
3. Number of Coats: One
4. Thickness of Coats: 8-10 mils.

E. Topcoat: Sealing or finish coats.
1. Resin: Key #446 Water Based Urethane - pigmented
2. Number of Coats: One or Two as required to match samples
3. Total Thickness of Coats: 2-3 mils per coat
4. Finish: Gloss.

PART 3 EXECUTION

3.1 PREPARATION

A. Verification of Conditions: Examine conditions under which products are to be installed in coordination with Installer of materials and components specified in this Section and notify affected General Contractors in writing, with copies to the Owner's Representative and Architect, of any conditions detrimental to proper and timely installation. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

B. When Installer confirms conditions as acceptable to ensure proper and timely installation and to ensure requirements for applicable warranty or guarantee can be satisfied, submit to General Contractor written confirmation, with copies to the Owner's Representative and Architect, from applicable Installer. Failure to submit written confirmation and subsequent installation will be assumed to indicate conditions are acceptable to Installer.

C. Prior to commencing work, the manufacturer, General Contractor, and Installer shall conduct a walk-through to review and determine the methods of joint treatment; contractor shall submit proposed joint treatment methods to Architect for review and approval prior to installation.

D. Preparation of Surface:

1. Inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence or quality of work.

a. Remove all projections, all debris detrimental to flooring system, dirt, oil contaminates, grease and surface coatings affecting bond.

2. Effectively remove concrete laitance by steel shot blasting or other mechanical method approved by flooring manufacturer. Surface profile must be a minimum CSP-3 profile according to International Concrete Repair Institute Guideline #03732

3. Concrete: Test for moisture content and moisture vapor emission rate. Install no flooring over concrete until the concrete has been cured and is sufficiently dry to achieve

permanence with flooring as determined by material manufacturer's recommended bond and moisture tests.

a. Testing must be done to verify that the moisture vapor emission rate of the slab does not exceed that as recommended by the manufacturer at time of installation of the flooring or at any future date. Moisture vapor emission and moisture content testing must conform with the requirements of ASTM F-1869-98 (Calcium Chloride Test) and ASTM F-2170-02 (Relative Humidity Probe Test). If test results show excessive levels of moisture content or vapor emission rate, installation shall not proceed until manufacturer is consulted.

4. Treat cracks in concrete using manufacturer's recommended practice. Rout out crack and fill with Key Urecon material. Do not coat surface with flexible crack isolation membrane treatment.

5. All expansion joints shall be honored through the finished flooring system. The floor materials shall be installed and after completion of the flooring, saw cut the expansion joint and fill with a suitable joint sealant as approved by the Floor materials manufacturer.

6. Notify Architect in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.

3.2 APPLICATION – FLOOR SYSTEM

A. Install all floor materials in strict conformance with manufacturer's instructions.

B. All control joints, expansion joints and cold joints shall be treated per manufacturer’s recommendations.

C. Place urethane cement body coat and spread to a dense flat surface. Maintaining a wet edge between mixes, establish the material thickness. Before surface has set, broadcast aggregate to excess. Allow to cure per manufacturers requirements and sweep/vacuum excess aggregate from surface.

D. Follow with a flake broadcast into epoxy and allow to cure. Sweep/vacuum excess aggregate from surface.

E. Seal surface with grout and top coats following recommended recoat and cure times to achieve approved non-skid texture. Be careful not to puddle resins.

F. Match finished work to approved sample; uniform in thickness, color, texture and free from defects detrimental to appearance.

3.3 APPLICATION – WALL SYSTEM

A. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

B. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

C. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.

D. Body Coat: Apply epoxy body coats in thickness indicated and cure as required.

E. Topcoats: Apply topcoat in number indicated for wall system and at spreading rates recommended in writing by manufacturer and to produce finish surface indicated.

F. Match finished work to approved sample; uniform in thickness, color, texture and free from defects detrimental to appearance.

3.4 PROTECTION AND CLEANING

A. Apply temporary protection until floor is fully cured. The General Contractor shall protect the finished floor from the time that the sub-contractor completes the work.

B. Dispose of waste legally.

C. Comply with waste management and recycling program requirements.

END OF SECTION

SECTION 09 68 13 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Walk-Off Mat

1.2 RELATED REQUIREMENTS

A. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

B. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

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1. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.6 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.1 MATERIALS

A. Tile Carpeting: , manufactured in one color dye lot.
1. Construction: Patterned Loop
2. Tile Size: 24" by 24" inch, nominal.
3. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 .
4. Fiber System: Dynex SD Nylon (Permanent Stain Resistance)
5. Dye Method: Solution Dyed
6. Pile Height Average: 0.203 in.
7. Pile Thickness: 0.079 in.
8. Total minimum Recycled Content: 75.5%
9. Pre-Consumer: 42.2%
10. Post Consumer: 33.3%
11. Secondary Back,ing: 50% Recycled Content
12. Intermediate Layer: Fiberglass Reinforced Sealant
13. Product Construction: No delamination per ASTM D-3936
14. Secondary Backing Density: 65 lbs/cu ft.
15. Secondary Backing Thickness: 0.050 inch
16. Manufacturer:
    a. Tarkett Aftermath III SD #11907, Basis of Design
    b. Or Approved Equal

B. Walk-Off Mat
1. Depth: 7/16 inches
2. Tread Spacing: 2" on-center tread spacing
3. Weight: 1.92 lb/sq. ft.
4. Rolling Load: 350 lb/wheel

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5. Tread Rails: PET-G
6. Rail/Frame Finish: Anodized
7. Surface Rails: Aluminum
8. Mounting: Recess Mounted, No Frame
9. Critical Radiant Flux: conforms to ASTM E-648
10. Insert: Heavy Duty Carpet
11. Manufacturer:
    a. Construction Specialties, Pedimat Model M1, Basis of Design
    b. Or Approved Equal

2.2 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Metal, color as selected by Architect.

C. Adhesives:
1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.

D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
1. Test in accordance with Section 09 05 61.
2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.2 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

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B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.3 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

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SECTION 09 84 30 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sound-absorbing panels.

1.2 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023, with Editorial Revision (2024).

B. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2016.

1.3 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout and wood grain orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

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C. Protect edges from damage.

PART 2 PRODUCTS

2.1 WOOD FIBER SOUND-ABSORBING UNITS

A. Manufacturers:
1. Cardinal Acoustics, Direct Attached Panels, Basis of Design
2. Approved Equal.

B. Wood Fiber Acoustical Panels for Walls: Cementitious wood fiber.
1. Size: As indicated on Drawings.
2. Thickness: 1 inch.
3. Noise Reduction Coefficient (NRC): 0.60 to .95 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
4. Panel Edge: Bevel/Bevel.
5. Surface Color: As indicated on Drawings; factory painted to match Architects sample.
6. Mounting: C20 Mounting Method

2.2 FABRICATION

A. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.3 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

B. Fixing Clips: Manufacturers standard for application as indicated.

C. Furring Strips: Metal hat channel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install mounting accessories and supports in accordance with shop drawings.

C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

D. Furring Mounted Wood Veneer Panels:
1. Install furring strip along meeting edges of adjacent panels to ensure they are attached to same furring strip along abutted edge; 24 inch on center, maximum.
2. Install acoustic back-up material between furring as required for application.
3. Adhere first panel from edge to furring strip, and attach subsequent panels using fixing clips.

E. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
1. Plumb and level.
2. Flatness.
3. Width of joints.

3.3 CLEANING

A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.4 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

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SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.
   2. Mechanical and Electrical:
      a. On the roof and outdoors, paint equipment exposed to weather or to view, including factory-finished materials.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Exterior insulation and finish system (EIFS).
   12. Glass.
   13. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 09 91 23 - Interior Painting.

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1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

D. SSPC-SP 2 - Hand Tool Cleaning; 2024.

E. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

F. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.4 SUBMITTALS

A. See Section 01 33 00 Suibmittals, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, submit each color in each sheen available.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Finish Materials: 1 gallon of each color and type; from the same product run, store where directed.
   2. Label each container with color and type in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

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1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Benjamin Moore: www.benjaminmoore.com.
2. PPG Paints: www.ppgpaints.com.
3. Sherwin-Williams Company: www.sherwin-williams.com.
4. Approved Equal

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.

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1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
      1) Opaque, Flat: 50 g/L, maximum.
      2) Opaque, Nonflat: 150 g/L, maximum.
      3) Opaque, High Gloss: 250 g/L, maximum.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Colors: As indicated in Color Schedule.
1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.3 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated on Drawings: Including primed metal.
1. Top Coat(s): Exterior 100% Acrylic Latex.
   a. Products:
      1) Benjamin Moore Ultra Spec Ext Gloss, N449.
      2) PPG Paints Speedhide Exterior Latex, 6-900XI Series, Semi-Gloss.
      3) Sherwin-Williams A-100 Exterior Acrylic Latex, A08 Series
      4) .Approved Equal
2. Top Coat(s): Exterior Light Industrial Coating, Water Based.
   a. Products:
      1) Benjamin Moore Ultra Spec HP D.T.M. Acrylic, HP29,

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2) Pittsburgh Paints Pitt-Tech Plus DTM Industrial Enamel, 4216 HP Series, Semi-Gloss.
3) Sherwin-Williams Pro Industrial DTM Acrylic Coating, B66 Series, Semi-Gloss.
4) Approved Equal

3. Top Coat Sheen: As specified for substrates below.
4. Primer: As specified under "PRIMERS" below.

B. Wood, Opaque, Latex, 3 Coat:
1. One coat of latex primer sealer.
2. Semi-gloss: Two coats of latex enamel.

C. Masonry/Concrete, Opaque, Latex, 3 Coat:
1. One coat of block filler.
2. Flat: Two coats of latex enamel.

D. Exterior Gypsum Board and Exterior Plaster, Opaque, Latex, 3 Coat:
1. One coat of latex primer sealer.
2. Flat: Two coats of latex.

E. Ferrous Metals, Unprimed, Light Industrial Coating, 3 Coat:
1. One coat of rust inhibitive primer.
2. Semi-gloss: Two coats of Light Industrial Coating.

F. Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
2. Semi-gloss: Two coats of Light Industrial Coating.

G. Galvanized Metals, Latex, 3 Coat:
1. One coat rust inhibitive primer.
2. Semi-gloss: Two coats of latex enamel.

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Interior/Exterior Latex Block Filler.
a. Products:
1) Benjamin Moore Ultra Spec Masonry Int/Ext High-Build Block Filler, 571.
2) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15XI.
3) Sherwin-Williams Loxon Block Surfacer, A24W00200.
4) Substitutions: Section 01 60 00 - Product Requirements.
2. Rust-Inhibitive Water Based Primer.
a. Products:
1) Benjamin Moore Ultra Spec HP Acrylic Metal Primer, HP04.
2) Pittsburgh Paints Pitt-Tech Plus DTM Industrial Primer, 4020 PF Series.
3) Sherwin-Williams Pro Industrial Pro-Cryl Primer, B66-310 Series.

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4) Approved Equal

3. Latex Primer for Exterior Wood.
   a. Products:
      1) Benjamin Moore Ultra Spec EXT Latex Primer.
      2) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series.
      3) Sherwin-Williams Exterior Latex Wood Primer, B42W08041.
      4) Approved Equal
      5) Substitutions: Section 01 60 00 - Product Requirements.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

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

E. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

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

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

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E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

G. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare rusty surface according to SSPC-SP 2.

H. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

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3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

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SECTION 09 91 23 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Prime surfaces to receive wall coverings.
   3. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
   10. Glass.
   11. Acoustical materials, unless specifically indicated.
   12. Concealed pipes, ducts, and conduits.
   13. Operating and moving parts of operating equipment, including valve and damper operators, linkages, sensing devices, and motor and fan shafts.

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1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

1.3 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020 (Reapproved 2025).

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

D. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

E. SSPC-SP 2 - Hand Tool Cleaning; 2024.

F. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

G. SSPC-SP 13 - Surface Preparation of Concrete; 2018.

1.4 SUBMITTALS

A. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

B. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

C. Manufacturer's Instructions: Indicate special surface preparation procedures.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Paint and Finish Materials: 1 gallon of each color and type; from the same product run, store where directed.

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2. Label each container with color, type, and room locations in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Benjamin Moore: www.benjaminmoore.com.
2. PPG Paints: www.ppgpaints.com.
3. Sherwin-Williams Company: www.sherwin-williams.com.

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C. Primer Sealers: Same manufacturer as top coats.

D. Approved equal.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
   a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
      1) Opaque, Flat: 50 g/L, maximum.
      2) Opaque, Nonflat: 150 g/L, maximum.
      3) Opaque, High Gloss: 250 g/L, maximum.
2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Colors: As indicated on drawings.
1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, wood, uncoated steel, shop primed steel, galvanized steel, aluminum, and acoustical ceilings.
1. Two top coats and one coat primer.
2. Top Coat(s): High Performance Architectural Interior Latex.

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a. Products:
1) Benjamin Moore Ultra Spec 500, 537
2) Benjamin Moore Scuff-X, 485
3) Sherwin-Williams Pre-Catalyzed Waterbased Epoxy, K45 Series,
4) Sherwin-Williams ProMar 200 HP Series
5) Approved equal.

3. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
a. Products:
1) Benjamin Moore Ultra Spec 500, 535
2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex
3) Approved equal.

4. Top Coat Sheen:
a. As indicated on Drawings

5. Primer: As specified under "PRIMERS" below.

B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
2. Two top coats and one coat primer.
3. Top Coat(s): Interior Urethane or Epoxy-Modified Latex.
a. Products:
1) Benjamin Moore Corotech Polyamide Epoxy Coating, V400
2) PPG Paints Aquapon WB EP Two-Component Waterborne Epoxy Coating, 98E-1/98E-98 Series.
3) Sherwin-Williams Waterbased Catalyzed Epoxy, B73 Series
4) Approved equal.

4. Top Coat Sheen:
a. As indicated on Drawings

5. Primer: As specified under "PRIMERS" below.

C. Concrete Floors to be Painted.
1. Two top coats and one coat primer.
2. TopCoat: High Performance Coating
a. Benjamin Moore HP4000 Polymide Epoxy, Basis of Design
b. Approved Equal

3. Primer: High Performance Primer
a. Benjamin Moor HP1550 Concrete and Metal Epoxy Primer, Basis of Design
b. Approved Equal

4. Slip Resistant Additive
a. H&C Products Group; H&C Sharkgrip Slip Resistant Additive, Basis of Design
b. Approved Equal

D. Transparent Finish on Concrete Floors.
1. Sealer: Water Based Sealer for Concrete Floors; MPI #99.

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a. Products:
1) Sherwin Williams Armorseal 8100 Water-Based Epoxy Floor Coating
2) Approved equal.

2. Sealer Sheen:
a. Matte MPI gloss level 6; use this sheen at all locations.

3. Slip-Resistant Additive
a. Products:
1) H&C Products Group; H&C Sharkgrip Slip-Resistant Additive
2) Approved Equal

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Alkali Resistant Water Based Primer; For Smooth Concrete.
a. Products:
1) Benjamin Moore Insl-x Aqua Lock Primer Sealer.
2) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI.
3) Sherwin-Williams Loxon Concrete & Masonry Primer, A24W8300.
4) Approved equal.

2. Interior/Exterior Latex Block Filler; For Rough Concrete and Masonry.
a. Products:
1) Benjamin Moore Insl-x Aqua Lock Primer Sealer.
2) PPG Paints: 6-15XI Speedhide Masonry Hi Fill Latex Block Filler.
3) Sherwin-Williams Loxon Block Surfacer, A24W00200.
4) Approved equal.

3. Interior Drywall Primer Sealer.
a. Products:
1) Benjamin Moore Ultra Spec 500 Interior Latex Primer, N534.
2) Pittsburgh Paints Speedhide Interior Latex Sealer, 6-2.
3) Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28 W02600
4) Approved equal.

4. Interior Rust-Inhibitive Water Based Primer; MPI #107.
a. Products:
1) Benjamin Moore Ultra Spec HP Acrylic Metal Primer, HP04.
2) Pittsburgh Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series.
3) Sherwin-Williams Pro-Cryl Universal Primer, B66-310 Series.
4) Sherwin-Williams Pro Industrial Pro-Cryl Primer, B66-310 Series.
5) Approved equal.

5. Latex Primer for Interior Wood; Plaster; or Gypsum Wallboard.
a. Products:
1) Benjamin Moore Ultra Spec 500 Interior Latex Primer, N534.

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2) Sherwin-Williams Premium Wall & Wood Interior Latex Primer, B28W08111; except ProMar 200 Zero VOC Interior Latex Primer, B28W02600, for gypsum wallboard.
3) Approved equal.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

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

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

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

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C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:
1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

G. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

L. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare rusty surface according to SSPC-SP 2.

M. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

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N. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with tinted primer.

P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.
   1. Fill joints of knock-down frames.

3.3 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

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SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Dimensional letter signage.

1.2 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

B. Shop Drawings:
1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

C. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.

D. Selection Samples: Where materials, colors, and finishes are not specified, submit two sets of selection charts or chips.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

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PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Dimensional Letter Signs:
1. Inpro Corporation
2. FASTSIGNS International, Inc.
3. Approved equal.

2.2 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.3 DIMENSIONAL LETTERS

A. Applications: Building identification.
1. Use individual metal letters.
2. Mounting Location: Exterior as indicated on drawings.

B. Metal Letters:
1. Material: Aluminum casting.
2. Thickness: 1/8 inch minimum.
3. Letter Height: As indicated on Drawings.
4. Text and Typeface:
a. Character Font: Helvetica, Arial, or other sans serif font.
5. Finish: As selected by Architect from manufacturer's full range.
6. Color: As selected by Architect from manufacturers full range of colors.
7. Mounting: Concealed screws.

2.4 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

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3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until substanhtial completion; repair or replace damaged items.

END OF SECTION

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SECTION 10 14 23 - PANEL SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Panel signage.

1.2 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

C. NFPA 170 - Standard for Fire Safety and Emergency Symbols; 2018.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

B. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
   2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
      a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
      b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
      c. Submit for approval by Owner through Architect prior to fabrication.

C. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

D. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.

E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

F. Manufacturer's qualification statement.

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1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

1.6 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Panel Signage Basis of Design:
1. Best Sign Systems, Inc.
2. Inpro Corporation
3. Seton Identification Products
4. Approved equal.

2.2 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

2.3 PANEL SIGNAGE

A. Panel Signage:
1. Description: Flat signs with vinyl, acrylic, or photopolymer media, tactile characters.
2. Sign Size: As indicated on drawings.
3. Total Thickness: 1/8 inch.
4. Sign Edges: Squared.
5. Letter Edges: Squared.
6. Corners: Squared.
7. Color and Font, unless otherwise indicated:
    a. Character Font: Helvetica, Arial, or other sans serif font.
    b. Character Case: Upper and lower case (title case).

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c. Background Color: As selected by Architect.
d. Character Color: Contrasting color.

8. Profile: Flat panel without frame.
   a. Clear Cover: For customer produced sign media, provide clear cover of polycarbonate plastic, glossy on back, nonglare on front.
9. Tactile Letters: Raised 1/32 inch minimum.
10. Braille: Grade II, ADA-compliant.
11. One-Sided Wall Mounting: Concealed screws.

2.4 SIGNAGE APPLICATIONS

A. Room and Door Signs:
   1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section for replaceable occupant name.
      a. Sign Sizes: 8 inches by 8 inches, unless otherwise indicated.
   2. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
      a. Sign Sizes: 8 inches by 6 inches, unless otherwise indicated.
   3. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.
      a. Sign Sizes: 8 inches by 10 inches, unless otherwise indicated.

B. Interior Directional and Informational Panel Signs:
   1. Directories: For customer-produced media; provide divider strips.
   2. Where suspended, ceiling mounted, or projecting from wall signs are indicated, provide two-sided signs with same information on both sides.

C. Equipment Room Identification Signs: Provide signs in accordance with NFPA 170 for rooms containing controls for air-conditioning systems, sprinkler risers and valves, and other fire detection, suppression or control elements.
   1. Sign Sizes: 6 inches by 6 inches, unless otherwise indicated.

D. Means of Egress Signage: Comply with the applicable building code for the following applications:
   1. Occupant Load in Assembly Spaces: Comply with the applicable building code for occupant load signs.
      a. Sign Sizes: 8 inches by 8 inches, unless otherwise indicated.
   2. Two-Way Communication Signs: Provide a sign at each two-way communication device giving instructions for its use. The two-way communication device manufacturer's standard sign will be acceptable if approved by Architect.
      a. Sign Sizes: 12 inches by 12 inches, unless otherwise indicated.
   3. Directional Signs:
      a. Sign Sizes: 12 inches by 12 inches, unless otherwise indicated.
   4. Tactile Exit Signs: Comply with the applicable building code for area of refuge and low level exit signs.
      a. Sign Sizes: 6 inches by 4 inches, unless otherwise indicated.

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5. Stair Floor Identification Signs: Comply with the applicable building code for Floor Identification Signs in stairs.
   a. Sign Sizes: 12 inches by 18 inch, unless otherwise indicated.
6. Elevator Lobby Identification Signs: Comply with the applicable building code for identification signs in stairs where there are two or more doors on an interior stair landing and one leads to an enclosed elevator lobby.
   a. Sign Sizes: 8 inches by 6 inches, unless otherwise indicated.

E. No Smoking Signs: Provide a sign at each building entrance in accordance with applicable law indicating that smoking is not permitted within 25 feet.
   1. Sign Sizes: 8 inches by 10 inches, unless otherwise indicated.

F. Roof Maintenance Sign: Provide a sign at each roof access.
   1. Provide window section and infill with the following information:
      a. Indicate: "Contact the roof manufacturer within 30 days of discovering a leak."
      b. Provide name and warranty contact information of the roof manufacturer, name of roof installer, date of substantial completion, warranty number, and date of expiration of warranty.
   2. Sign Sizes: 10 inches by 15 inch, unless otherwise indicated.

2.5 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with horizontal edges level.

C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until mm-dd-yyyy; repair or replace damaged items.

END OF SECTION

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SECTION 10 21 13.15 - STAINLESS STEEL TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Stainless steel toilet compartment partitions floor mounted, for following applications:

a. Toilet enclosures.

B. Related Requirements:
1. Division 03 Section "Cast in Place Concrete"
2. Division 04 Section "Unit Masonry"
3. Division 05 Section "Metal Fabrications"

1.2 REFERENCES

A. ASTM International (ASTM):
1. ASTM A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
3. ASTM A 743/A 743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
4. ASTM B 86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.
5. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
6. ASTM B 221/B 221M - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings.

B. International Code Council (ICC)/American National Standards Institute (ANSI):
1. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities, as applicable to toilet compartments designated as accessible.

C. United States Department of Justice:
1. ADA - Americans with Disabilities Act, Excerpt from 28 CFR Part 36 - ADA Standards for Accessible Design.

D. GREENGUARD Environmental Institute (GREENGUARD):
1. GREENGUARD certified low emitting products.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets for each type of product indicated. Include fabrication details, description of materials and finishes.
   1. Product Test Reports: When requested by Architect, submit documentation by qualified independent testing agency indicating compliance of products with requirements.

B. Shop Drawings: Include overall product dimensions, floor plan, elevations, sections, details, and attachments to other work. Include choice of options with details.

C. Samples for Verification: Furnish physical sample of material in selected finish.
   1. Size: 2 by 2 inch (52 by 52 mm) minimum, in type of finish specified.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance and cleaning instructions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Approved manufacturer listed in this section, with minimum [5] years experience.

B. Installers Qualifications: Experienced Installer with a minimum 3 years experience.

C. Source Limitations: Obtain toilet compartment components and accessories from single manufacturer.

D. Accessibility Requirements: Comply with requirements of ICC/ANSI 117.1, and with requirements of authorities having jurisdiction.

E. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 0.
   2. Smoke-Developed Index: 0.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver toilet compartments to site until building is enclosed and HVAC systems are in operation.
   1. Deliver toilet compartments in manufacturer's original packaging.

2. Store in an upright condition.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship during the following period after substantial completion:
   1. Stainless Toilet Partitions: Against rust-out: 15 years.
   2. Chrome Hardware: 5 years.
   3. Stainless Steel Hardware: Lifetime.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of The Mills Company, Marion, OH 43302.

B. Approved Equal

2.2 MATERIALS

A. Stainless Steel Sheet: A 666, 300 series commercial stainless steel sheet suitable for exposed applications. Provide smooth material, without creases or ripples.
   1. Finish: As selected by Architect from manufacturers full range.

B. Stainless Steel Castings: ASTM A 743/A 743M.

C. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

D. Aluminum: ASTM B 221/B 221M.

2.3 STAINLESS STEEL TOILET COMPARTMENTS

A. Toilet Compartment Type:
   1. Floor anchored.
      a. Basis of Design Product: Bradley, Mills Partitions, Floor Braced, Series 500.
   2. Wall-hung with Brackets:
      a. Basis of Design Product: Bradley, Mills Partitions, Model No. 4.

B. Door, Panel, and Pilaster Construction, General: Form edges with interlock to provide watertight fit without crown molding. Braze corners and finish smooth.

1. Provide exposed surfaces free of pitting, visible seams and fabrication marks, stains, telegraphing of core material, or other imperfections.
2. Core Material: Manufacturer's standard sound-deadening, water resistant honeycomb in thickness required to provide finished thickness for doors, panels and pilasters.

C. Door Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) stainless steel.
1. Provide each door with internal 0.0625 inch/16 ga (1.59 mm) and 0.0781 inch/14 ga (1.98 mm) welded reinforcements at top and bottom hinge locations, with factory installed concealed true gravity cam hinges.

D. Panel Construction: 1 inch (25 mm) thick, constructed from 0.0313 inch/22 ga (0.794 mm) stainless steel.
1. Grab-Bar Reinforcement: Provide concealed internal reinforcement for grab bars mounted on units.

E. Pilaster Construction: 1 1/4 inch (32 mm) thick, constructed from 0.048 inch/18 gauge (1.219 mm)] stainless steel.
1. Provide pilaster with internally welded bracket suitable to accept minimum 3 inch (76 mm) long, 5/16 inch (7.9 mm) stainless steel hex bolt for leveling.

F. Shoes: 4 inches (102 mm) high minimum, Type 304 stainless steel with No. 4 satin brushed finish. Secured to the floor with tamper-resistant screws.

G. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.4 HARDWARE

A. Hardware, Heavy Duty: Manufacturer's heavy-duty stainless steel castings, including stainless steel tamper-resistant fasteners:
1. Hinges: Self-closing continuous spring-loaded type, adjustable to hold doors open at any angle up to 90 degrees, with emergency access by lifting door. Mount with stainless steel through-bolts.
2. Keeper: Wrap-around flat, rubber-faced combination door strike and keeper, with provision for emergency access, meeting requirements for accessibility at accessible compartments.

2.5 FABRICATION

A. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

B. Door Size and Swings: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine work area to verify that measurements, substrates, supports, and environmental conditions are in accordance with manufacturer's requirements to allow installation.
   1. Proceed with installation once conditions meet manufacturer's requirements.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

B. Install toilet partitions in spaces with operating, temperature controlled HVAC systems. Shield partitions from direct sunlight.

C. Clearances: Install with clearances indicated on Drawings.

D. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel. Locate wall brackets so holes for wall anchors occur in masonry or tile joints. Align brackets at pilasters with brackets at walls.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 15 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

3.4 FINAL CLEANING

A. Remove packaging and construction debris and legally dispose of off-site.

B. Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Protective wall panels

1.2 SUBMITTALS

A. See Section 01 33 00 Submittals, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, anchorage details, and rough-in measurements.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
1. Submit two sections of corner guards, 24 inches long.
2. Submit two samples of protective wall panel, 6 by 6 inches square.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

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1.4 WARRANTY

A. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Protective Wall Panels: Extruded semi-rigid PVC panel:
   1. Altro Puraguard, Basis of Design
   2. Tarkett.
   3. Approved equal.

2.2 PRODUCT TYPES

A. Protective Wall Panels:
   1. Material: Extruded semi-rigid PVC Panel
   2. Thickness: 0.08 inch.
   3. Panel Size: 4 ft x 9 ft
   4. Color, Pattern, and Texture: Smooth Finish, Salt Color.
   5. Fire and Smoke Performance: Tested Class A
   6. Accessories: Provide manufacturers standard color matched trim and moldings
      a. 1-Part Joint Strip 10'
      b. 1 -Part Start and Edge Trim 10'
      c. Internal Corner 10'
      d. External Cover 10'

B. Adhesives and Primers: As recommended by manufacturer.

2.3 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that substrate surfaces for adhered items are clean and smooth.
   1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.

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C. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.
   1. Full-Height Installation: Establish a plumb line located at edge of starting point of first sheet to ensure following sheets will be installed plumb.
   2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
   3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
   4. At joints indicated to be caulked, allow for a minimum 1/16 inch wide gap between edges of sheets. Gaps are required to be of consistent width throughout the project.
   5. Seams to be welded.
   6. Use a roller to ensure maximum contact with adhesive.
   7. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch.

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.4 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

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SECTION 10 28 00 - TOILET AND BATH ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes toilet and bath accessory items as scheduled.

1.2 SUBMITTALS

A. General: Submit the following according to Conditions of Contract and Division 01 Specifications Sections.

B. Product data for each toilet accessory item specified, including construction details relative to materials, dimensions, gages, profiles, mounting method, specified options, and finishes.

1.3 QUALITY ASSURANCE

A. Inserts and Anchorages: Furnish accessory manufacturers' standard inserts and anchoring devices that must be set in concrete or built into masonry. Coordinate delivery with other work to avoid delay.

B. Single-Source Responsibility: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise acceptable to Architect.

1.4 PROJECT CONDITIONS

A. Coordination: Coordinate accessory locations, installation, and sequencing with other work to avoid interference with and ensure proper installation, operation, adjustment, cleaning, and servicing of toilet accessory items.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering toilet accessories that may be incorporated in the Work include, but are not limited to, the following:
   1. Bradley Corporation Basis of Design, or approved equal
   2. Norix Furniture, Detention Accessories, Basis of Design, or approved equal
   3. Whitehall Manufacturing, Basis of Design
   4. Kingsway Group, Basis of Design
   5. American Specialties, Inc., or approved equal

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6. Bobrick Washroom Equipment, Inc., or approved equal
7. Brey Krause Manufacturing Co., or approved equal

2.2 MATERIALS, GENERAL

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034 inch minimum thickness.

B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.

C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04 inch minimum. Surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 527 G60.

E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

F. Baked Enamel Finish: Factory-applied, gloss white, baked acrylic enamel coating.

G. Mirror Glass: Nominal 6.0 mm thick, conforming to ASTM C 1036, Type I, Class 1, Quality q2, and with silvering, electro- plated copper coating, and protective organic coating. Provide tempered glass at all mirrors.

H. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

I. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.3 BATHROOM ACCESSORIES

A. TOILET TISSUE DISPENSERS

1. Single Roll Dispenser with Roll in Reserve: Holds two rolls up to 4 ½" W x 5-1/4" diameter standard rolls, one above the other. 22 gauge stainless steel, door has tumbler lock.
   a. Bradley Model 5A10, Basis of Design
   b. American Specialties
   c. Bobrick
   d. Or Approved Equal

B. Towel Dispenser
1. Surface mounted 22-gauge stainless steel with architectural satin finish. Hinged at bottom for easy filling. Capacity: 525 multifold or 400 C-fold paper towels.
2. Products:
   a. Bradley Model 250-15, Basis of Design
   b. American Specialties

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c. Bobrick
d. Or Approved Equal

C. Grab Bars
1. 3 1/8" diameter, 11 gauge type 304 stainless steel flanges heliarc welded to 1 1/2" O.D. 18 gauge seamless tube. Suicide resistant 11 gauge closure plate heliarc welded to edge between tube and wall. Brushed stainless steel finish. Lengths as indicated on drawings.
2. Products:
a. Bradley Model SA70, sizes as indicated on drawings, Basis of Design
b. Approved Equal

D. SANITARY NAPKIN DISPOSAL UNITS
1. Surface-Mounted Type: Fabricate of stainless steel with seamless exposed walls, tightly self-closing top cover with continuous, stainless steel piano hinge. 1.5 Gallon Capacity
2. Products:
a. Bradley Model 4A10-11, Basis of Design
b. American Specialties
c. Bobrick
d. Or Approved Equal

E. LIQUIDSOAP/GEL SANITIZER DISPENSER
1. Surface mounted automatic liquid soap or gel sanitizer dispenser. Capacity 27 oz. Body is heavy gauge stainless steel with satin finish. Plastic battery box that holds 4 “AA” alkaline batteries, not included.
a. Bradley Model 6A03-110000, Basis of Design
b. American Specialties
c. Bobrick
d. Or Approved Equal

F. ADA SHOWER SEAT
1. Frame is 18 gauge 1” diameter tubing with 1 ½” HDPE support bars. Seat is ½” thick solid phenolic. White matte finish Melamine bonded to phenolic for color. Seat folds up and out of way when not in use; supports 250 lbs, static load.
2. Products:
a. Bradley Model 9569, Basis of Design
b. Approved Equal

G. Shower Caddy
1. Surface mounted, Ligature resistant shower caddy with sloping top fabricated from 16 gauge, type 304 stainless steel with all exposed surfaces powder coated white. Furnished with ¼”-20 UNC Tamper Resistant Screws for use with wall anchors by others.
2. Products:
a. Whitehall Manufacturing, Model WH1183, Basis of Design
b. Approved Equal

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H. Break-A-Way Shower Tracks
   1. Extruded 6063-T5 aluminum track
   2. 1 – 7/16” by 1-9/16” by .062” wall thickness
   3. Ceiling mounted
   4. Finish: Satin anodized
   5. Products:
      a. Imperial Privacy Systems LLC, Model IFC-69, Basis of Design
      b. Approved Equal

I. Break-A-Way Shower Curtain
   1. Width equal to track length from which shower curtain is hung, plus 6 additional inches for fullness.
   2. Length equal to floor to ceiling height minus 2 inches above finished floor at bottom.
   3. Top hem to be 1-1/2” wide and double lock stitched with 1-1/2 wide loop tape sewn to top hem
   4. Curtain fabric to be Sure-Chek Privacy curtain
      a. Color: As selected by Architect from manufacturers full range of colors.
   5. Mesh Top: No. 50, 20” wide, ½ hole nylon mesh
      a. Color: As selected by Architect from manufacturers full range of colors.
   6. Clear Panel at Bottom
   7. Products:
      a. Imperial Privacy Systems LLC, Sure Chek Privacy Curtains, Basis of Design
      b. Approved Equal

J. Robe Hook
   1. Stainless steel double robe hook, projects 2 ¼”
   2. Products:
      a. Bradley Model 9124 Basis of Design
      b. American Specialties
      c. Bobrick
      d. Or Approved Equal

K. Mop and Broom Holder/Utility Shelf: Surface mounted utility shelf fabricated of 18-gauge stainless steel in stain finish. Hooks shall be 14-gauge stainless steel. Holders shall be spring activated rubber cams on plated steel retainers. Will hold a broom or mop with diameter between 5/5” and 1”. 4 hooks and 3 holders
   1. Products:
      a. Bradley Model 9933 – 34, Basis of Design
      b. American Specialties
      c. Bobrick
      d. Or Approved Equal

L. Mop and Broom Holder: 22 gauge stainless steel with architectural satin finish. Three (3) spring activated rubber cams on plated steel retainers to hold mop or broom handles with diameter between 5/8” and 1”.
   1. Products:

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a. Bradley Model 9953, Basis of Design
b. American Specialties
c. Bobrick
d. Or Approved Equal

M. Mirror Units
1. Standard Stainless Steel Framed Mirror Units: Mirror shall be framed with one-piece, roll-formed stainless steel with 3/4" face and neatly mitered corners. Double-strength continuous integral stiffener on all sides. Back of unit shall be galvanized steel. Separate mounting brackets for concealed mounting. Mirror shall be of first quality 1/4"float glass, guaranteed for 15 years against silver spoilage and protected by shock absorbing, neoprene tubing with Poly-Glaze protective finish.
a. Bradley Model 780-1830, Basis of Design
b. American Specialties
c. Bobrick
d. Or Approved Equal

2.4 DETENTION BATHROOM ACCESSORIES

A. Ligature Resistant Spindle Button Toilet Paper Holder
1. Surface mounted, 16 gauge, type 304 stainless steel powder coated white housing. Ligature resistant, spring-loaded, spindle button. Furnished with ¼”-20 UNC tamper resistant screws for use with installer provided wall anchors.
2. Products:
a. Whitehall Manufacturing, Model WH1847B, Basis of Design
b. Approved Equal

B. Ligature Resistant Spindle Button Paper Towel Holder
1. Surface mounted, 16 gauge, type 304 stainless steel powder coated white housing. Ligature resistant, spring-loaded, spindle button. Furnished with ¼”-20 UNC tamper resistant screws for use with installer provided wall anchors.
2. Products:
a. Whitehall Manufacturing, Model WH1848B, Basis of Design
b. Approved Equal

C. Security Grab Bars
1. 3 1/8" diameter, 11 gauge type 304 stainless steel flanges heliarc welded to 1 1/2" O.D. 18 gauge seamless tube. Suicide resistant 11 gauge closure plate heliarc welded to edge between tube and wall. Brushed stainless steel finish. Lengths as indicated on drawings.
2. Products:
a. Bradley Model SA70, sizes as indicated on drawings, Basis of Design
b. Approved Equal

D. Security Soap Dispenser - Surface Mount

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1. Stainless steel, surface-mounted liquid soap dispenser, manually operated. Removeable, refillable dispensing bottle.
    a. Kingsway Group Model KG07, Basis of Design
    b. Approved Equal

E. Security Wall Mirror
1. Frame is 14 gauge stainless steel, seamless construction with exposed surface in architectural satin finish. Mirror is 20 gauge stainless steel polished to No. 8 architectural finish. Torx-head machine screws provided for installation to wall anchors (not provided).
2. Products:
    a. Bradley Model SA03-1, Basis of Design, Basis of Design
    b. Norix
    c. Approved Equal

F. SECURITY ADA SHOWER SEAT
1. Cut, formed and welded steel and stainless steel frame to fit wall opening with 1/2" diameter solid stainless steel hinge. 700 pound static load.
2. Products:
    a. Norix Model ISS-200, Basis of Design
    b. Approved Equal

G. Shower Caddy
1. Surface mounted, Ligature resistant shower caddy with sloping top fabricated from 16 gauge, type 304 stainless steel with all exposed surfaces powder coated white. Furnished with ¼”-20 UNC Tamper Resistant Screws for use with wall anchors by others.
2. Products:
    a. Whitehall Manufacturing, Model WH1183, Basis of Design
    b. Approved Equal

H. Break-A-Way Shower Tracks
1. Extruded 6063-T5 aluminum track
2. 1 – 7/16” by 1-9/16” by .062” wall thickness
3. Ceiling mounted
4. Finish: Satin anodized
5. Products:
    a. Imperial Privacy Systems LLC, Model IFC-69, Basis of Design
    b. Approved Equal

I. Break-A-Way Shower Curtain
1. Width equal to track length from which shower curtain is hung, plus 6 additional inches for fullness.
2. Length equal to floor to ceiling height minus 2 inches above finished floor at bottom.
3. Top hem to be 1-1/2” wide and double lock stitched with 1-1/2 wide loop tape sewn to top hem
4. Curtain fabric to be Sure-Chek Privacy curtain
    a. Color: As selected by Architect from manufacturers full range of colors.

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5. Mesh Top: No. 50, 20” wide, ½ hole nylon mesh
   a. Color: As selected by Architect from manufacturers full range of colors.
6. Clear Panel at Bottom
7. Products:
   a. Imperial Privacy Systems LLC, Sure Chek Privacy Curtains, Basis of Design
   b. Approved Equal

J. Clothes/Towel Hook
1. Housing fabricated from 14 gauge 304 stainless steel, powder coated white. Hook is satin finish stainless steel. Auto-release hooks have an adjustable release range of zero to 25 lbs. Unit furnished with 1/4"-20 UNC tamper resistant screws for use with installer provided anchors.
2. Products:
   a. Whitehall Manufacturing Model WH1830A-SLPT, Basis of Design
   b. Approved Equal

2.5 FABRICATION

A. General: No names or labels are permitted on exposed faces of toilet and bath accessory units. On either interior surface not exposed to view or on back surface, provide identification of each accessory item either by a printed, waterproof label or a stamped nameplate indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Mirror Units, General: Fabricate frames for glass mirror units to accommodate wood, felt, plastic, or other glass edge protection material. Provide mirror backing and support system that will permit rigid, tamperproof glass installation and prevent moisture accumulation, as follows:
1. Provide galvanized-steel backing sheet, not less than 0.034 inch and full mirror size, with nonabsorptive filler material. Corrugated cardboard is not an acceptable filler material.

E. Mirror Unit Hangers: Provide system for mounting mirror units that will permit rigid, tamperproof, and theft proof installation, as follows:
1. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
2. Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

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F. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install toilet accessory units according to manufacturers' instructions, using fasteners appropriate to substrate as recommended by unit manufacturer. Install units plumb and level, firmly anchored in locations and at heights indicated.

B. Secure mirrors to walls in concealed, tamperproof manner with special hangers, toggle bolts, or screws. Set units plumb, level, and square at locations indicated, according to manufacturer's instructions for type of substrate involved.

C. Install grab bars to withstand a downward load of at least 250 lbf, complying with ASTM F 446.

D. Security toilet accessories to be installed and/or attached to concrete surfaces. Install as per manufacturer's instructions using supplied hardware, if applicable.

3.2 ADJUSTING AND CLEANING

A. Adjust toilet accessories for proper operation and verify that mechanisms function smoothly. Replace damaged or defective items.

B. Clean and polish all exposed surfaces strictly according to manufacturer's recommendations after removing temporary labels and protective coatings.

END OF SECTION

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SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

B. FM (AG) - FM Approval Guide; Current Edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers; 2026.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

A. See Division 01 Section for submittal requirements.

B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, and rough-in measurements for recessed cabinets.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers and Cabinets
   1. Larsen's Manufacturing Co.
   2. Nystrom, Inc.

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3. Potter-Roemer
4. Approved equal.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Size: 10 pound.
   3. Temperature range: Minus 40 degrees F to 120 degrees F.

2.3 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Cabinet Construction: Non-fire rated.
   1. Formed primed steel sheet; 0.036 inch thick base metal.

C. Fire Rated Cabinet Construction: Provide if wall is rated; match rating of wall.
   1. Steel; double wall or outer and inner boxes with fire barrier material.

D. Cabinet Configuration: Semi-recessed type.
   1. Interior nominal dimensions of 9 inch wide by 24 inch high by 6 inch deep.
   2. Trim: Flat square edge, with 1-3/4 inch wide face.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

E. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

F. Door Glazing: Tempered glass, clear, 1/8 inch thick, and set in resilient channel glazing gasket.
   1. Configuration: Vertical duo.

G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

H. Fabrication: Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected by Architect from manufacturers full range

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J. Finish of Cabinet Interior: Color as selected by Architect from manufacturers full range of colors.

2.4 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in locations indicated on drawings and in additional locations and quantities as required by NFPA 10 and applicable codes, whichever is more stringent.

B. Install in accordance with manufacturer's instructions.

C. Install cabinets plumb and level in wall openings, 24 inches from finished floor to inside bottom of cabinet.

D. Secure rigidly in place.

E. Place extinguishers in cabinets.

END OF SECTION

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SECTION 10 51 13 - METAL LOCKERS

][PPART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal lockers.

1.2 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.

D. ASTM F1267 - Standard Specification for Metal, Expanded, Steel; 2018 (Reapproved 2023).

E. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

1.3 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Samples: Submit two samples 4 by 4 inches in size showing color and finish of metal locker material.

E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Metal Lockers:
   1. Spacesaver Corporation, Day Use Lockers, Basis of Design

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2. Approved equal.

2.2 LOCKER APPLICATIONS

A. Day Use Lockers: Metal lockers, free-standing with matching closed base.
   1. LK-1: 18"w x 18"d x 60"h 1-Tier
   2. LK-2: 12"w x 12"d x 60"h 2 tier
   3. LK-3: 18"w x 12"d x 60"h 4-tier
   4. Fittings: Size and configuration as indicated on drawings.
      a. Number tags
      b. Hooks: Single prong interior hook
   5. Provide sloped top.
   6. Locking Mechanism:
      a. LK-1: Hasp only
      b. LK-2: Hasp Only
      c. LK-3: CombiPro Mechanical Locker Lock, public and private modes

2.3 METAL LOCKERS

A. Locker Case Construction:

B. Doors: Hollow two pieces of 20 gauge steel, box formed and riveted together. Full overlay style and 3/4" thick. ,

C. Latches and Door Handles: Manufacturer's standard.

D. Hinges: One-piece wrap around hinge constructed of steel and nickel plated to open 110 degrees.

E. Sloped Top: 20 gauge, 0.0359 inch, with closed ends.

F. Leveling Base: 4" hiogh recessed or flush base with levelers for leveling adjustment..

G. Trim: 20 gauge, 0.0359 inch.

H. Coat Hooks: Stainless steel or zinc-plated steel.

I. Number Tags: Adhesive tags identifying individual lockers

J. Locking Mechanism
   1. Hasp: Allows use of any lock to secure locker or remain accessible when vacant.
   2. Mechanical Locker Lock (LK-3 only): Allows use and convenience of codes to manage locker access. Flush mounted
      a. Manufacturer:
         1) Ojmar Combi Pro, Basis of Design
         2) Approved Equal

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PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install fittings if not factory installed.

H. Replace components that do not operate smoothly.

3.3 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

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SECTION 10 51 18 – PISTOL LOCKERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Key locked pistol lockers as indicated.

B. Related Sections include the following:
1. Division 09 - Gypsum Board Assemblies: Blocking in metal stud partitions for anchorage of pistol lockers.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.

1.3 SUBMITTALS

A. Provide in accordance with Division 01 Section Administrative Requirements.
1. Product data for pistol lockers, materials, finishes, mounting hardware, and accessories.
2. Shop drawings showing locker type, dimensions, and anchorage.
3. Finish samples.
4. Installation and maintenance instructions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. American Locker Security Systems, Basis of Design

B. Precision Locker Company

C. Storage Systems USA

D. Approved Equal

2.2 FOUR COMPARTMENT HINGED DOOR PISTOL LOCKER

A. Type: Wall or recessed mounted, 4 compartment, hinged door, key locked unit; 4 Compartment Pistol Locker as manufactured by American Locker Security Systems.

B. Fabrication: Completely factory assembled from 20 gage steel sheet with thermoset, gray enamel finish.

C. Doors: 16 Gauge patterned stock and hinged with full piano hinges.

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D. Overall size: 28 3/32 inch H x 14 ¼ inch W x 4”

E. Compartments: 4 equal sized compartments each with plastic holster.

F. Mounting hardware: Provide fasteners, brackets, and other hardware of type and size recommended by manufacturer for type of substrate.

G. Lock: Security type, stainless steel assembly provided with 2 keys per compartment. Key and cylinder removable for replacement.

H. Key system: Proprietary system to protect against unauthorized duplication.

2.3 SINGLE COMPARTMENT PISTOL LOCKER

A. Type: Wall or recessed mounted, single compartment, hinged door, key locked unit; Pistol Locker as manufactured by American Locker Security Systems.

B. Fabrication: Completely factory assembled from 20 gage steel sheet with baked, gray enamel finish.

C. Door: 16 Gauge patterned stock and hinged with full piano hinges.

D. Overall size: As indicated.

E. Equip compartment with plastic holster.

F. Mounting hardware: Provide fasteners, brackets, and other hardware of type and size recommended by manufacturer for type of substrate.

G. Lock: Security type, stainless steel assembly provided with 2 keys per compartment. Key and cylinder removable for replacement.

H. Key system: Proprietary system to protect against unauthorized duplication.

PART 3 EXECUTION

3.1 PREPARATION

A. Provide blocking and recesses in walls (where indicated) as recommended by manufacturer and shown on approved shop drawings.

3.2 INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer's instructions.

B. Install locker units plumb, square, and aligned.

C. Arrange locker modules in sequence of locker numbers.

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D. Anchor lockers to walls or horizontal surfaces as indicated on approved shop drawings with appropriate anchor devices to suit adjacent materials and finishes.

E. Field quality control: After installation lock, unlock, open, and close each locker. Verify that doors operate smoothly. Adjust as required for proper use.

F. Cleaning: Wash exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean cloths. Do not use abrasives.

END OF SECTION 10 51 18

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SECTION 11 10 92 – DETENTION EQUIPMENT (SECURITY HARDWARE)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Security hardware and necessary setting and adjustment information/assistance for complete security metal doors and frames.

1.2 RELATED WORK

A. Division 08 Section 08 11 13 Hollow Metal Doors and Frames

1.3 REFERENCES

A. ASTM F1577-96 Test Methods for Detention Locks for Swing Doors

B. ASTM F1643-95 Test Methods for Detention Sliding Door Locking Device Assembly

C. National Electrical Code, latest edition, for internal electrical requirements for hardware

1.4 SUBMITTALS

A. Make submittals in accordance with the requirements of Division 01 Section “Submittals”.

B. Submit specifications, installation instructions and general recommendations for products as required, including locks, hinges, lock mount covers, bolt keepers, wall bumpers, weatherstripping, thresholds, escutcheons, etc.

C. Hardware and Keying Schedules:

a. Submit one reproducible and one copy of each schedule type; indicate all products by name and number for each separate opening. Include all other pertinent hardware and keying information.
b. Hardware Supplier is required to coordinate a detention keying meeting with the architect and user so as not to delay the manufacturer and delivery of the required detention equipment.
c. Make promptly, any corrections or changes necessary in schedules to comply with requirements; resubmit one reproducible and one copy of revised schedules.
d. Do not group doors with like or similar hardware under a single heading.

D. Templates for Fabrication:

1. Forward templates for each type of detention equipment hardware required to fabricators of work in Division 11 Section 11191, “Security Hollow Metal” following final review of hardware and keying schedules.

2. Submit wiring diagrams for all electrical devices provided herein.

E. Locking Device Shop Drawings:

1. Indicate layout plans of each opening at 1/2" = 1'-0" minimum scale, show anchorage and accessory items, dimensions and finishes. Note: Complete housing module plans can be drawn at 1/4" = 1'-0" minimum, with typical enlarged plans.
2. Indicate complete details of internal components of sliding door locking mechanisms located in transoms and jambs.

F. Closeout Submittals - Furnish three copies of Operating/Maintenance Manuals including parts lists for security locks and locking devices.

1.5 PRODUCT HANDLING

A. For products delivered to door manufacturer and for products delivered to project site, package each item of hardware separately in containers, complete with necessary fasteners, installation instructions and installation templates. Mark each container with item numbers, location of installation in accord with corresponding information shown on final hardware schedule.

B. Store products at site to prevent damage or loss until installation is made.

C. Control handling and installation of hardware products, which are not immediately replaceable, so that the completion of work will not be delayed by hardware losses, both before and after installation.

D. Deliver all keys in one shipment by secure carrier (hand carrier or registered mail) from manufacturer directly to authorized representative of the Owner, as directed by the Architect-Engineer. Include transmittal and forward copy of same to the Architect-Engineer.

1.6 MAINTENANCE

A. Provide spares in the quantities listed below for each hardware type:

1. Locks: Two of each type used (one left hand, one right hand).

2. Escutcheon: Four of each type used.

3. Cylinder Shield: Four of each type used.

4. Hinges - A: Six of each type used.

5. Door Position Switch (DPS): Four of each type used

6. Closer - A: Four of each type used.

7. Pulls:
   a. Door Pull: Four of each type used
   b. Flush Pull: Four of each type used

8. Wall Bumper: Twelve of each type used

9. Weather Threshold: Two sets, 4’ lengths.

10. Pass-Resistant Threshold: Four sets, 4’ lengths.

11. Weatherstripping/Smoke Gasketing: Twelve sets

12. Jamb Switch (Keeper Switch): Three of each type used.

13. Food Pass hardware: Three food pass door sets complete with all hardware:
   a. 1 ea - Lock
   b. 2 ea - Hinges
   c. 1 ea - Pass door with integral pull
   d. 1 ea - Rubber bumper

14. Kickplate:
   a. 10” x (door width less 2”) x 14 gage stainless steel, US32D finish, with security screws. Provide four.
   b. 34” x (door width less 2”) x 14 gage stainless steel, US32D finish, with security screws. Provide four (per key quantities schedule only).

B. Locking Device Spare Parts:

1. Locking Device I: Provide six complete sets of switches, motor assemblies and internal parts.

C. Fasteners and Accessories:

1. Furnish five percent extra fasteners and other miscellaneous accessories required for installation.

D. Furnish, for institution use only, four complete sets of:

1. Special tools required for locking device and hardware maintenance
2. Lock repair ki

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Catalog numbers of the first manufacturers listed have been used to establish the quality required. The only other manufacturers approved are listed. Other manufacturers seeking approval shall do so in writing per General Requirements and shall list exact catalog numbers and description of the items proposed to furnish.

ITEM	1	2
Hinges	Southern Folger	
Closers	LCN	Norton
Stops	H.B. Ives	Glynn-Johnson
Holders, Surface Bolts	Glynn-Johnson	Checkmate
Push, Pull	Hiawatha	Brookline
Thresholds	Pemko	Reese
Weatherstrip	Pemko	Reese
Security Hardware	Southern Folger	

B. DESIGNATIONS: Following abbreviations identify listed manufacturers:

Brookline	Brookline Industries, Chicago, IL
Checkmate	Rixon, Inc.; Franklin Park, IL
Glynn-Johnson	Glynn-Johnson Corp.; Chicago, IL
Hiawatha	Metalcraft, Inc.; Minneapolis, MN
Ives	H. B. Ives Div.; New Haven, CT
LCN	LCN Closers; Princeton, IL
Norton	Norton Closer Div.; Charlotte, NC
Pemko	Pemko Mfg. Co.; Emeryville, CA
Reese	Reese Enterprises; Rosemount, MN
Southern Folger	Southern Folger Detention Equipment Company, San Antonio, TX

2.2 SCREWS, FASTENERS AND TOOLS:

A. Furnish exposed fasteners to match item fastened. Make fastener of the same metal as item fastened, except use plated brass or stainless steel for all aluminum items. Provide twenty (20) spares of each type of fastener used for anchoring hardware.

B. Provide torx-head (star design with center pin) security fasteners for exposed fasteners on all security hardware, regardless of manufacturer. Furnish six (6) tool holders and six (6) bits for

each different size screw. Holders and bits shall be left at project after installation and become property of the user.

2.3 ELECTRIC SECURITY LOCKS FOR SWINGING DOORS (8" JAMB MOUNTED)

A. Series/Manufacturer

1. Folger Adam 120-Series/Southern Folger

B. 120 series jamb mounted medium security electric lock set shall include lock, plug connector, strike, and Maxi-mogul cylinder for mechanical release.

C. Lock Functions:
1. 1. 120E-1-01 Lock - Solenoid operated deadlatch with latchback and deadlock indication switch.
2. 2. 120M-1-01 Lock - Motor operated deadlatch with latchback and deadlock indication switch.
3. 3. 120MC-1-04 Lock - A two-position motor operated deadlatch with holdback and deadlock indication switch.
4. 4. 120ED-3-01 Lock - Solenoid retracted deadbolt, re-locked only by key, with indication switch.

D. Series of Operation:
1. 1. Provide remote electrical control of operation with local mechanical operation by key cylinder.
2. 2. Provide remote electrical control of operation with local mechanical operation by key cylinder one side and knob operation other side.
3. 3. LEK: Provide local electric key option for lock function 1 and 2. LEK feature shall operate the lock only when selected at the control console.

E. MATERIAL:
1. Lock case and cover: 10 Gauge steel.
2. Bolt: Investment cast bolt from stainless steel with hardened inserts. Bolt type is a 1-inch throw deadlatch or deadbolt.
3. Bolt opening in case shall not allow access to internal mechanism.
4. Deadlock Lever: Stainless steel, adjustable for variations in door gap.
5. Roller Bolt: Investment cast stainless steel with stainless steel roller.
6. Operating Lever: Stainless steel to operate with solenoid, motor, deadlatch or deadbolt.
7. Strike: Investment cast stainless steel attached with screws in two directions.
8. Solenoid: 115VAC continuous duty with stainless steel guides.
9. Motor: 115VAC permanently lubricated fractional HP with thermal overload and positive brake. UL listed.
10. Springs: Stainless steel.
11. Cylinder: Maxi Mogul cylinder - refer to 2.10

F. PERFORMANCE

1. Locks shall comply with UL 1034 Burglary Resistant Electric Locking Mechanisms.
2. Deadlatch models -1, shall comply with UL 10B Fire Tests of Door Assemblies, Class A - 3 Hour Rating. (Some models may not qualify for fire rating due to specific functions, consult factory.)
3. Cylinder shall comply with UL 437 Key Locks.
4. Design lock mechanism to operate a minimum of one million cycles without failure.
5. Lock shall comply with ASTM 1577-96 Grade 1.

2.4 ELECTRIC SECURITY LOCKS FOR SWINGING DOORS (2" JAMB MOUNTED)

A. Series/Manufacturer:

1. NS400-Series/Southern Folger

B. NS400 series jamb mounted institutional security electric lock set shall include lock, plug connector, strike, and high security builders hardware cylinder for mechanical release.

C. Lock Functions:
1. NS400E-01 - Solenoid operated deadlatch with latchback and deadlock indication switch.
2. NS400M-01 - Motor operated deadlatch with latchback and deadlock indication switch.
3. NS400MC-04 - Two-position motor operated deadlatch with holdback and deadlock indication switch.
4. NS400MCD-04 - Two-position motor operated deadbolt with holdback and deadlock indication switch.

D. Operational Control:
1. Provide remote electrical control of lock operation and local mechanical operation by key cylinder.
2. Locks keyed one side are designated 402, keyed both sides are 406. Supply cylinder extensions for locks keyed out the stop side of the jamb.
3. LEK - Provide local electric key option. Keys shall electrically operate the lock when selected from the control console.
4. IPB-1: Provide local inmate push button option. Push button shall electrically operate the lock when selected at the control console.

2.5 MECHANICAL LOCKS

A. Medium Security - Mechanical Operation:

1. Series/Manufacturer:

a. Folger Adam 10-Series/Southern Folger

B. General: Lever tumbler locks shall operate with paracentric key. Key all lever tumbler locks into one keying system. Key locks alike in groups or key differently to the approved keying schedule. Master keying is not permitted for lever tumbler locks. Include lock mounting, escutcheons, strike and mounting screws for a complete application. Use break off head security screws on lock mounting and strike. Use Torx tamper resistant screws on cylinder escutcheons.

C. 10 series deadlock for access panels, key cabinets and electrical panels.
   1. Material:
      a. Case - Malleable iron casting.
      b. Cover - Cold finished steel, 1/4 inch thick.
      c. Deadbolt - Cold finished steel, Electro-galvanized, 3/4 inch thick, 5/8 inch throw.
      d. Cylinder - Investment cast, silicon brass alloy, for key one side (12) or key both sides (16).
   2. Performance:
      a. Key operated deadlock. Key removable in the locked and unlocked positions.
      b. Galvanize case, cover and deadbolt.
      c. Comply with paragraph 2.03.C & D. Keys, cylinders and tumbler sets.
   3. Accessories:
      a. Lock mountings - HM for hollow metal doors, P for plate doors.
      b. 10-4DB Strike - 3/16 inch steel with dust box to protect bolt, and mounting screws.

2.6 MECHANICAL LOCKS

A. Medium Security - Mechanical Operation (Food Pass):

   1. Series/Manufacturer:

      a. 80-Series/Folger Adam

B. General: Lever tumbler locks shall operate with paracentric key. Key all lever tumbler locks into one keying system. Key locks alike in groups or key differently to the approved keying schedule. Master keying is not permitted for lever tumbler locks. Include lock mounting, escutcheons, strike and mounting screws for a complete application. Use break off head security screws on lock mounting and strike. Use Torx tamper resistant screws on cylinder escutcheons.

C. 80 Series maximum security deadlock.

   1. Material:
      a. Case - Drop forged carbon steel.
      b. Cover - Cold finished steel, 3/8 inch thick.
      c. Deadbolt - Cold finished steel, electro-galvanized, 3/4 inch thick with three 1/4 inch diameter hardened steel roller pins, 3/4 inch throw.
      d. Cylinder - Investment cast, silicon brass alloy, for key one side (82) or key both sides (86).

   2. Performance:

a. Include anti-bind feature to prevent tumblers from binding with side pressure applied to deadbolt. Lock shall operate under a 300 pound side load test.
b. Key operated deadlock. Key removable in the locked and unlocked positions.
c. Galvanize case, cover and deadbolt.
d. Comply with paragraph 2.03.C & D. Keys, cylinders and tumbler sets.

3. Accessories:
a. Lock mountings - G for grille doors, H for hollow metal doors, P for plate doors.
b. 80-4DB Strike - 3/16 inch steel with dust box to protect bolt, and mounting screws.
c. 80-4BL Strike - 3/16 inch steel with dust box and switch to monitor bolt position.

2.7 ELECTRIC LOCK FOR EXTERIOR GATES

A. Jamb-Mounted Lever Tumbler Electric Lock for Exterior Gates

1. 800 series fence post-mounted maximum security electric lock set shall include: Lock, adjustable fence gate mounting and gate tongue, and a five-lever tumbler number 16 lock for mechanical release. Furnish solenoid-operated locks, galvanized for use on exterior gates.

B. Lock Functions:

1. 806 ESL Lock- Solenoid-operated deadbolt for swinging gates with deadlock indication switch.

2. 806 ERL Lock - Solenoid-operated deadbolt for sliding gates with deadlock indication switch.

3. Lock bolt shall automatically deadlock in the locked position.

4. Add a second L to the lock description for indication of locking tongue position.

C. MATERIAL

1. Case and Cover: 7 Gauge steel, galvanized for exterior use.

2. Bolt: 3/4-inch diameter stainless steel, with automatic deadlocking.

3. Solenoid: 115VAC continuous duty with stainless steel guides.

4. Terminal Strip: Pre-wire lock to terminal strip. Provide a push-in-type quick-connect terminal strip for field wiring.

D. Design the lock mechanism to operate a minimum of one million cycles without failure.

2.8 HINGE

A. Series/Manufacturer:

1. 204FMSS/Southern Folger

B. Description:

1. 4-1/2 x 4-1/2, 3/16” thick leaves maximum
2. Stainless steel leaves, stainless steel non-removable pin, two hardened steel ball bearings, three knuckle with HT hospital tips.
3. 1/2” diameter pin to lock hinge in closed position

C. Provide quantities as follows:

1. Doors less than 5 ft high - 1 pair
2. Doors over 5 ft to 7 ft 6 in - 1-1/2 pair
3. Doors over 7 ft 6 in to 10 ft - 2 pair
4. Doors over 3 ft 8 in wide - 2 pair

2.9 DOOR POSITION SWITCH:

A. Series/Manufacturer:
1. 220A/Southern Folger

B. Description:

1. 6-1/4” x 2-1/2” x 1-7/8”
2. Enclosed is a 10 gauge galvanized steel housing
3. Surface mounted to frame with a pivoting operator that actuates internal switch mounted to the door face.

2.10 PULLS

A. Raised Door Pull

1. Series/Manufacturer: 212B/Southern Folger

a. Description: Cast brass, US4, 8-11/16” L x 1-3/4” W x 2-3/8” projection. Fasteners shall be 2-3/8” – 16 x ¾” security screws

2. Series/Manufacturer: 212C/Southern Folger

a. Description: Cast brass, US26D, 8-11/16” L x 1-3/4” W x 2-3/8” projection. Fasteners shall be 2-3/8" - 16 x 3/4" security screws.

B. Recessed Door Pull

1. Series/Manufacturer: 214S/Southern Folger

a. Description: Cast brass, US26D, 5” high x 4” wide x 1” deep. Fasteners shall be 1/4" - 20 x 5/16" security screws.

2. Series/Manufacturer: 214B/Southern Folger

a. Description: Cast brass, US4, 5” H x 4” W x 1” D. Fasteners shall be ¼” – 20 x 5/16” security screws.

2.11 FINISHES:

	U/S Symbol	ANSI Symbol	Description
Hinges, Exterior	US32D	630	Satin Stnls Stl
Hinges, Interior	US26D	626	Satin Chrome
Locks & Pulls	US26D	626	Satin Chrome
Closers	AL	689	Aluminum Painted
Push, Kick	US32D	630	Satin Stnls Stl
Stops	US26D	626	Satin Chrome

2.12 CYLINDERS, KEYS AND KEYING:

A. The security locks will incorporate three (3) separate keying systems; one for pin tumbler (mogul cylinder) and one for commercial cylinder locks. Each keying system's keys shall be dye stamped for identification; corresponding to the hardware supplier's final schematic keying chart (See Paragraph 'E').

B. Mogul cylinder locks shall be master keyed as directed. Provide cut change keys, and master keys as required.

C. For all individual key designations, to each required individual Key Cabinet, there shall be two (2) keys provided. For each master key designation, there shall be three (3) keys for each required individual key cabinet.

D. A complete, detailed schematic chart of the keying system will be required. The hardware supplier will also be required to enter the key symbols for all doors on additional floor plans which will be supplied by the Architect. Two (2) copies of the schematic keying chart and architectural floor plans shall be turned over to the user at the completion of the project. The cost for this service shall be included with the cost of materials at the time of bidding.

2.13 KEY CABINET:

A. Key control shall be furnished with a capacity of 1.75 times the number of individual key designations.

B. Cabinets shall have concealed-type hinge and rounded sides.

C. Panels must have individual hook and label pockets formed as an integral part of the panel, for mogul key types, as required.

D. Keys shall not leave the manufacturer's custody without prior arrangements for delivery and authorization from the Owner.

2.14 SECURITY SPARE LOCKS AND LOCK PARTS:

A. Shall be provided for the Owners' stock as follows:

1. One complete set of security screw drivers for all sizes of security screws used on this project.
2. One repair parts list and assembly drawings bound in a manual for all security products supplied in this section.

2.15 DOOR AND HARDWARE SCHEDULE

A. The hardware group/sets listed below indicate the items of hardware required for each opening. It is the bidder's responsibility to accurately furnish the proper sizes, quantities, weights, gage and function as required by these specifications and as recommended by manufacturers involved.

HARDWARE SET S01 CONTROLLED CELL DOORS (2-inch Jamb)

QTY	MFG	Product #	Description
3 ea.	**Southern Folger**	**204FMSS**	**4 ½ x 4 ½ Mortised Hinge**
1 ea.	**Folger Adam**	**NS400MC-04**	**24 VDC Electro-Mechanical Dead Latch**
1 ea.	**Southern Folger**	**214S**	**Recessed Door pull**
1 ea.	**Southern Folger**	**200MRS-TB**	**Door Position Switch**
1 ea.	**Southern Folger**	**420**	**Detention Door Stop**

HARDWARE SET S02 CONTROLLED CORRIDOR AND EXTERIOR DOORS (2-inch Jamb)

QTY	MFG	Product #	Description
3 ea.	Southern Folger	204FMSS	4 ½ x 4 ½ Mortised Hinge
1 ea.	Folger Adam	NS400MC-04	24 VDC Electro-Mechanical Dead Latch
2 ea.	Southern Folger	212C	Loop Pull
1 ea.	LCN	2215	Door Closure
1 ea.	Southern Folger	200MRS-TB	Door Position Switch
1 ea.	Southern Folger	420	Detention Doorstop

HARDWARE SET S03 CONTROLLED CORRIDOR AND EXTERIOR DOORS (8-inch Jamb)

QTY	MFG	Product #	Description
3 ea.	Southern Folger	204FMSS	4 ½ x 4 ½ Mortised Hinge
1 ea.	Folger Adam	126M	Electro-Mechanical Dead Latch
2 ea.	Southern Folger	212C	Loop Pull
1 ea.	LCN	2215 DPS	High Quality LCN Closer
1 ea.	Southern Folger	420	Detention Door Stop
3 ea.	Hager	307D	Door Silencer

HARDWARE SET S04 CHASE (Monitored Only)

QTY	MFG	Product #	Description
3 ea.	Southern Folger	204FMSS	4 ½ x 4 ½ Mortised Hinge
1 ea.	Folger Adam	60-4DB	Mechanical Deadlock
1 ea.	LCN	2213 (ST) short track	Door Closure
1 ea.	Southern Folger	200MRS-TB	Door Position Switch
1 ea.	Southern Folger	420	Detention Door Stop
3 ea.	Hager	307D	Door Silencer

HARDWARE SET S05 EXISTING CELL – FOOD PASS ONLY

QTY	MFG	Product #	Description
1 ea.	Folger Adam	10 Series Deadlock	Cuff Port Lock
2 ea.	Southern Folger	203FP	Food Pass Hinge

HARDWARE SET S06 DOOR POSITION SWITCH ONLY

QTY	MFG	Product #	Description
1 ea.	Southern Folger	200MRS-TB	Door Position Switch

HARDWARE SET S07 ELECTRIC GATE LOCK

QTY	MFG	Product #	Description
1 ea.	Folger Adam	800 Series Gate Lock	Electric Gate Lock

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with requirements of Division 11 Section “Basic Detention Equipment Requirements.”

B. All shipping of detention equipment hardware and coordination with other detention equipment shall be the responsibility of the Detention Equipment Supplier.

3.2 FIELD QUALITY CONTROL

A. Comply with requirements of Division 11 Section “Basic Detention Equipment Requirements.”

3.3 ADJUSTMENT AND REPAIRING

A. Comply with requirements of Division 11 Section “Basic Detention Equipment Requirements.”

3.4 PROTECTION AND CLEANING

A. Comply with requirements of Division 11 Section 11190, “Basic Detention Equipment Requirements.”

END OF SECTION

SECTION 11 30 13 - RESIDENTIAL AND COMMERCIAL APPLIANCES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Kitchen appliances.

B. Laundry appliances.

1.2 RELATED REQUIREMENTS

A. Division 26: Electrical connections for appliances.

1.3 REFERENCE STANDARDS

A. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Electric Appliances: Listed and labeled by UL (DIR) and complying with NEMA Standards (National Electrical Manufacturers Association).

B. Gas Appliances: Bearing design certification seal of American Gas Association (AGA).

1.6 WARRANTY

A. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

B. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

C. Provide 10 year limited parts warranty on stainless steel cylinders of washer and dryer against rust through.

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PART 2 PRODUCTS

2.1 KITCHEN APPLIANCES

A. Provide Equipment Eligible for Energy Star Rating: Energy Star Rated.

B. Refrigerator: Free-standing, top-mounted freezer, and frost-free.
1. Capacity: Total minimum storage of 21.31 cu. ft. cubic ft; freezer capacity 6.13 cu. ft..
2. Annual Energy Consumption: 399 kWh
3. Features: Include glass shelves,Flexi-Slide Bin, Gallon Door Storage, Electronic Temperature Control, Freezer Temperature Control, Humidity Controlled Crispers, LED Bulbs, Electronic Controls.
4. Dimensions: 32 3/4" W x 66 1/4"H x 34"D
5. Exterior Finish: Monochromatic Stainless Steel.
6. Amperage: 6.5
7. Voltage: 120
8. Manufacturers:
   a. Whirlpool Corp; Model WRT541SZDM, Basis of Design:
   b. Approved equal.

C. Range: Electric, free-standing, with glass-ceramic cooktop.
1. Dimensions: 30"W x 35 9/16"H x 26"D
2. Oven: Steam Clean 30 minute cycle.
3. Total Capacity: 5.3 cu. ft.
4. Elements: five (5).
5. Controls: Touch, Knob.
6. Features: Include .Broil element,Halogen bulb,radiant burners, Convection, Digital Display,Door Lock, Viewing Window,2 racks, warming function
7. Exterior Finish: Stainless steel.
8. Manufacturers:
   a. Frigidaire Home Products; Model FCFE3062AS, Basis of Design
   b. Approved equal.

D. Cooking Exhaust: Range hood.
1. Dimensions: 4 5/16"H x 30"W x 19 3/4" D.
2. Fan: Three-speed, 500 cfm
3. Exhaust: Rectangular, recirculated.
4. Features: Include . Mechanical Push Button Controls, 2 Halogen Cooktop Lights, 3 speed fan
5. Air Delivery: 300 CFM
6. Exterior Finish: Stainless steel.
7. Manufacturers:
   a. Frigidaire Home Products; Model FHWC3040MS, Basis of Design
   b. Approved equal.

E. Microwave: Countertop.

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1. Capacity: 0.7 cubic ft.
2. Power: 700 watts.
3. Dimensions: 12.25 H x 21.75W x 18.31D
4. Capacity: 1.6 cu. ft.
5. Wattage: 1200 Watts
6. Features: Include turntable, end of cycle indicator, clock, timer.
7. Exterior Finish: Stainless Steel.
8. Manufacturers:
    a. Frigidaire Home Products; WMCS7022, Basis of Design:
    b. Approved equal.

2.2 LAUNDRY APPLIANCES

A. E-1 Clothes Washer: Light Commercial Top-loading stationary.
1. ADA Compliant
2. Capacity: 16 lbs..
3. Cylinder Volume: 2.19 cu. ft.
4. Controls: Mechanical Knob.
5. Cycles: Include Soak/Prewash, Heavy Duty/Permanent Press, Normal Eco, Delicate.
6. Motor Speed: Two-speed.
7. Dimensions: 25.625"W x 43"H x 28"D
8. Electrical Requirements: 120v/60Hz/1-15Amp
9. Cylinder Finish: Stainless Steel .
10. Manufacturers:
    a. Speed Queen Light Commercial Model TV2000WN, Basis of Design
    b. Approved equal.

B. E-2 Clothes Dryer, Light Commercial: Electric, .
1. ADA Compliant
2. Capacity: 18 lbs
3. Cylinder Volume: 7.0 cu. ft.
4. Controls: Mechanical Knob
5. Cycles: Automatic Permanent Press/Knits, Automatic Regular/Delicate, Time Dry
6. Heating Element: 5350W, 240V/4750W, 208V
7. Electrical Requirements: 120/208/240/60/1-30 Amp
8. Cycles: Include automatic permanent press/knits, automatic regular/delicate, time dry.
9. Dimensions: 26.875"W x 45"H x 29.5"D
10. Finish: Painted steel , color white.
11. Manufacturers:
    a. Speed Queen Light Commercial Model # DV2000WE, Basis of Design
    b. Approved equal.

C. E-3 Commercial Clothes Washer Front-loading.
1. ADA Compliant
2. Capacity: 22 lbs.
3. Cylinder Volume: 3.5 cu. ft.

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4. Motor: Variable Speed, reversible, thermo-protected, high efficiency, controlled induction
5. Dimensions: 27"W x 43 1/4"H x 30 1/8"D
6. Electrical Rating: 120V/60 Hz/1-phase
7. Breaker Requirements: 15A
8. Warranty:
    a. 3 year limited part warranty on all washer parts
    b. 5 year limited parts warranty on outer cylinder, bearings and seals
    c. 5 years limited parts warranty on steel cabinet panels against rust through from the inside out.
    d. 10 years limited parts warranty on stainless steel cylinder against rust through
    e. 1 year limited parts warranty on coin meters
9. Manufacturers:
    a. Wascomat Crossover 2.0 OPLL, Non-Metered - WHLFP817OPL, Basis of Design
    b. Approved equal.

D. E-4 Commercial Clothes Dryer Front-loading.
1. Cylinder Volume: 7.0 cu. ft.
2. Dimensions: 27"W x 42 1/2"H x 29"D
3. Gas Connection: 3/8 in MNPT
4. Gas Heating: 18,000 BTU/hr
5. Tumbling Speed 50 rpm
6. Warranty:
    a. 3 years limited parts warranty on all dryer parts, except coin meters, which are one year
    b. 5 years limited parts warranty on the motor and all steel cabinet panels against rust through from inside out
    c. 10 years limited parts warranty on the drum and outer cylinder against rust through
    d. 1 year limited parts warranty on coin meters sold as original equi[pment.
7. Manufacturers:
    a. Wascomat Crossover 2.0 Free Model #DLHF0817GDC, Basis of Design

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify utility rough-ins are provided and correctly located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

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3.3 ADJUSTING

A. Adjust equipment to provide efficient operation.

3.4 CLEANING

A. Remove packing materials from equipment and properly discard.

B. Wash and clean equipment.

END OF SECTION

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SECTION 11 40 00 – FOOD SERVICE EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Food service equipment.

B. Connections to utilities.

1.2 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

C. ASTM C1036 - Standard Specification for Flat Glass; 2025.

D. NFPA 70 – National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

F. NSF2 – Food Equipment; 2025

G. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

H. UL (DIR) - Online Certifications Directory; Current Edition.

1.3 SUBMITTALS

A. See Section 01 33 00 - Submittals, for submittal procedures.

B. Product Data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility service connection locations, service characteristics, and wiring diagrams.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

D. Operation Data: Provide operating data for the specified equipment.

E. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products clear of floor in a manner to prevent damage.

B. Coordinate size of access and route to place of installation.

1.5 WARRANTY

A. See Section 01 70 00 -Project Closeout, for additional warranty requirements.

B. Correct defective work of this section within a five year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty for replacement or repair of scheduled equipment, refrigerant and compressors, including disconnection and removal of defective unit, and connection of replacement unit.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Equipment Schedule: Refer to schedule at end of this section.
1. Equipment Eligible for Energy Star Rating: Provide Energy Star Rated equipment
2. Cooler and Freezer Units: Listed by UL (DIR).
3. Electrical Wiring and Components and Self-Contained Refrigeration Systems: Comply with UL (DIR) listed product standards.
4. Exhaust Hoods: Comply with NFPA 96 and SMACNA (KVS).

B. Installation Accessories: Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories as required for complete installation.

2.2 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Stainless Steel Sheet: ASTM A666 Type 304 commercial grade, No. 4 finish.

C. Glass: ASTM C1036, annealed, and laminated, 4 mm thick; exposed edges ground; cut or drilled to receive hardware.

D. Plastic Laminate: NEMA LD 3, HGS; acid-resistant; color as selected; textured, low gloss finish.

E. Laminate Backing Sheets: NEMA LD 3, BKL; unfinished, plastic laminate.

F. Finish Hardware: Manufacturer's standard.

G. Work Surfaces: Stainless steel.

H. Fittings: Sink drains with crumb cup and waste fittings, faucets, and electrical outlets.

I. Service Outlet Covers and Escutcheons: Stainless Steel.

2.3 FABRICATION

A. Install rubber button feet on bearing surface of any item positioned on a finished surface.

B. Isolate rotating or reciprocating machinery to prevent noise and vibration.

C. Provide indirect drain piping from equipment to terminate over nearest waste receptor.

D. Accommodate site installation of other services or equipment.

2.4 FINISHES

A. Components: Shop finish.

B. Metal (Except Stainless Steel): Degrease and phosphate etch, prime and apply minimum two coats factory baked epoxy, color as selected.

C. Stainless Steel: No. 4 finish.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify ventilation outlets, service connections, and supports are correct and in required location.

B. Verify that electric power is available and of the correct characteristics.

3.2 INSTALLATION

A. Install items in accordance with manufacturers' instructions.

B. Insulate to prevent electrolysis between dissimilar metals.

C. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements.

D. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

E. Use anchoring devices appropriate for equipment and expected usage.

3.3 CLOSEOUT ACTIVITIES

A. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct Owner in operating procedures and maintenance.
   1. Test equipment prior to demonstration.
   2. Individual Performing Demonstration: Fully knowledgeable of all operating and service aspects of equipment.

3.4 PROTECTION

A. Remove protective coverings from prefinished work.

B. Protect finished work from damage.

END OF SECTION

3.5 EQUIPMENT LIST

A. ITEM 1 - STAINLESS STEEL PASS-THRU SHELF WITH ROLL DOWN GRILL (1 REQ'D)
   1. EXISTING EQUIPMENT

B. ITEM 2 - SPARE NO. <Spare No.>

C. ITEM 3 - HOT FOOD SERVING COUNTER, 4 WELL (1 REQ'D)
   1. EXISTING EQUIPMENT

D. ITEM 4 - 12' STAINLESS STEEL WORK COUNTER WITH SINK (1 REQ'D)
   1. EXISTING EQUIPMENT

E. ITEM 5 - EXHAUST HOOD (1 REQ'D)
   1. EXISTING EQUIPMENT

F. ITEM 6 - FIRE PROTECTION SYSTEM (1 REQ'D)
   1. EXISTING EQUIPMENT

G. ITEM 7 - SIX BURNER RANGE WITH 36" GRIDDLE, GAS (1 REQ'D)
   1. Southbend (Middleby) Model 4721AA-3G
   2. Ultimate Restaurant Range, gas, 72", (6) non-clog burners, (1) 36" griddle, standing pilot, (2) convection ovens with battery spark ignition, includes (3) racks per oven, 22-1/2" flue riser with shelf, stainless steel front, sides & shelf, 6" adjustable legs, 326,000 BTU, cCSAus, CSA Flame, CSA Star, NSF
   3. Domestic Shipping, inside of North America
   4. Standard one year limited warranty (range)
   5. Natural Gas – ¾” gas connection @ 326,000 BTU
   6. 115v/60/1-ph, 5.9 amps, 6'cord & plug, per oven
   7. Griddle to the right
   8. NOTE: 22.5" high flue riser, with heavy duty shelf, standard
   9. Casters, 3 locking & 3 standard, in lieu of legs
   10. 3/4" quick disconnect with 4' hose

H. ITEM 8 - CONVECTION OVEN, GAS (1 REQ'D)
   1. Blodgett (Middleby) Model ZEPH-100-G DBL
   2. Zephaire Convection Oven, gas, double-deck, standard depth, capacity (5) 18" x 26" pans per compartment, (SSI-M) solid state infinite controls with 60 min. manual timer, two speed fan, flue connector, dependent glass doors, interior light, stainless steel front, sides & top, 6" stainless steel legs, 100,000 BTU, ETL, NSF
   3. 2 year parts, 2 year labor and 1 additional year door warranty (parts only), standard
   4. Natural gas – ¾” gas connection @ 100,000 BTU
   5. (2) 115v/60/1-ph, 6.0 amps, 2-wire with ground, cord & plug, 1/2 hp, standard
   6. Model SSI-M Top Oven: Solid State infinite control with 60 min. manual timer

7. Model SSI-M Bottom Oven: Solid State infinite control with 60 min. manual timer
8. Draft diverter, stainless steel, standard
9. 6" plate casters (set)
10. NOTE: DO NOT deduct cost of standard legs
11. Gas manifold for double ovens
12. 48" flexible gas hose with quick disconnect & restraining device

I. ITEM 9 - 14" X 72" STAINLESS STEEL WORK TABLE (1 REQ'D)
   1. EXISTING EQUIPMENT

J. ITEM 10 - POT & PAN SHELVING UNIT (1 REQ'D)
   1. Metro Model PR48ES
   2. Mobile Pot & Pan Rack, 48"W x 24"D x 68"H, (4) shelves solid embossed stainless steel (2) 5MP polyurethane swivel casters & (2) 5MPB polyurethane swivel casters with brake, NSF

K. ITEM 11 - 31" X 12'6" (3) COMPARTMENT POT SINK (1 REQ'D)
   1. EXISTING EQUIPMENT

L. ITEM 12 - UNDERCOUNTER DISHWASHER (1 REQ'D)
   1. EXISTING EQUIPMENT

M. ITEM 13 - HAND SINK (2 REQ'D)
   1. Eagle Group Model HSAP-14-EYE
   2. Hand Sink, wall mount, 14" wide x 16" front-to-back x 5" deep bowl, 16/304 stainless steel construction, splash mount gooseneck faucet with wrist handles & mixer valve, marine edge on front & sides, splash mounted electronic-eye hand wash faucet with battery backup and tepid water temperature thermostatic mixing valve, 1/2" NPS water inlet, chrome-plated P-trap, wrist handles, soap dispenser, basket drain, skirt assembly & paper towel dispenser, PHYSICALLY CHALLENGED, NSF

N. ITEM 14 - WORK TABLE, STAINLESS STEEL TOP (1 REQ'D)
   1. Eagle Group Model T3048STE
   2. Spec-Master® Series Work Table, 48"W x 30"D, 14/300 series stainless steel top, rolled edges on front & back, Uni-Lok® gusset system, stainless steel crossrails on side & rear, (4) stainless steel legs & adjustable bullet feet, NSF
   3. Model 501571 Drawer, 20" x 20" x 5", with pull flange & full front, stainless steel , hemmed safety pull handle

O. ITEM 15 - SHELVING, WALL MOUNTED (1 REQ'D)
   1. Eagle Group Model WS1248-16/3
   2. Shelf, wall-mounted, 48"W x 12"D, rolled front edge, 1-1/2"H up-turn on sides & rear, includes stainless steel mounting brackets stud welded to shelf, 16/304 stainless steel construction, NSF

P. ITEM 16 - PLASTIC SHELVING (35 REQ'D)
   1. Metro Model MAX4-2148G
   2. Quick Ship - MetroMax® 5 Shelf, 48"W x 21"D, with removable polypropylene open grid mats & (4) wedge connectors, built in Microban® antimicrobial product protection, 800 lb. capacity per shelf, NSF
   3. 1 ea Top-Track System
   4. 5 kt Model MXTTM21C MetroMax Top-Track™ Mobile Unit Kit, 21"W, includes: (4) MX74UP 74"H corrosion proof posts, (4) bumpers, (4) roller assemblies, (2) caster channels & (4) plate casters, compatible with MetroMax® 4™ & MetroMax® Q™ shelves (sold separately), NSF
   5. 1 st Model TTS13NA Super Erecta®, MetroMax® Q™ Top-Track Track Set, 13 ft., includes: necessary sections of track for assembling track runs (only (1) track set is required between stationary units), NSF
   6. 1 kt Model MXTTE21 MetroMax Top-Track™ End Unit Kit, includes components for (2) 21"W stationary end units: (8) 86"H corrosion-proof polymer posts, track supports & hardware, compatible with MetroMax® 4™ & MetroMax® Q™ shelves (sold separately), NSF

Q. ITEM 17 - PLASTIC SHELVING (15 REQ'D)
   1. Metro Model MAX4-2142G
   2. Quick Ship - MetroMax® 5 Shelf, 42"W x 21"D, with removable polypropylene open grid mats & (4) wedge connectors, built in Microban® antimicrobial product protection, 800 lb. capacity per shelf, NSF
   3. 12 ea Model MQ74UPE Quick Ship - MetroMax® Q Post, 73-3/16"H, for use with stem casters, epoxy coated steel with built in Microban® antimicrobial product protection, taupe
   4. 6 ea Model 5PCX Quick Ship - Polymer Stem Caster, swivel, 5" dia., 1-1/4"W face, -20° F to 120°F temperature range, polyurethane wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)
   5. 6 ea Model 5PCBX Quick Ship - Polymer Stem Caster, brake, 5" dia., 1-1/4"W face, -20° F to 120°F temperature range, polyurethane wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)

      TOTAL QUANTITY OF THREE (3) SHELVING UNITS

R. ITEM 18 - PLASTIC SHELVING (50 REQ'D)
   1. Metro Model MAX4-2148G
   2. Quick Ship - MetroMax® 5 Shelf, 48"W x 21"D, with removable polypropylene open grid mats & (4) wedge connectors, built in Microban® antimicrobial product protection, 800 lb. capacity per shelf, NSF

3. 40 ea Model MQ74UPE Quick Ship - MetroMax® Q Post, 73-3/16"H, for use with stem casters, epoxy coated steel with built in Microban® antimicrobial product protection, taupe
4. 20 ea Model 5PCX Quick Ship - Polymer Stem Caster, swivel, 5" dia., 1-1/4"W face, -20° F to 120°F temperature range, polyurethane wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)
5. 20 ea Model 5PCBX Quick Ship - Polymer Stem Caster, brake, 5" dia., 1-1/4"W face, -20° F to 120°F temperature range, polyurethane wheel tread, 300 lb. capacity, NSF (donut bumpers included) (for use with all MetroMax posts & shelves)

TOTAL QUANTITY OF TEN (10) SHELVING UNITS

S. ITEM 19 - WALK-IN COOLER/FREEZER (1 REQ'D)
1. EXISTING EQUIPMENT

T. ITEM 19A - FREEZER CONDENSING UNIT / EVAPORATOR (1 REQ'D)
1. RUSSELL Model RFON230L4AEA-NT / RAL6E092DDARSF
    a. Freezer - Outdoor R454a split system w/ EcoNET
    b. 1-year refrigeration system labor warranty (Freezer)
    c. 208-230V/3ø/60Hz/2.25HP Scroll compressor
    d. MCA=15, MOPD =15, AWEF: 3.14
    e. 39.875W x 28.25D x 18.75H x 230lbs.
2. (1) Russell R454a air cooled condensing unit #RFON230L4AEA-NT
    a. w/ (2) DSE motors (1A) & electric defrost (9.8A)
    b. 208-230V/1ø/60Hz
    c. 43.625W x 15.5D x 18.125H x 50lbs.
3. (1) Russell R454a Next-Gen All-Temp evaporator model #RAL6E092DDARSF
    a. (1) ea. Russell outside line check valve for Next-Gen All-Temp evaporators (1-4 fans)
    b. (1) ea. Russell outside line solenoid valve for Next-Gen All-Temp evaporators (1-4 fans)
    c. 4-year extended compressor warranty (Freezer)
4. <Optional> Imperial Brown Model SWING DOOR / HEATED AIR VENT 1 ea. 36" x 78" overlap model G3 self-closing freezer swing door (LEFT hinge) [A]
   FRAME: 3-sided flat frame (Left = 6", Right = 6", Top = 6"), 3-sided double frame (Left = 6", Right = 6", Top = 6"), 4-sided heat cable
   LEAF: 4" thick, 3-side lap, Magnetic gasket, 2 1/4" black neoprene sweep
   LEAF WILL NOT BE RAISED UNLESS SPECIFIED OTHERWISE
   HARDWARE: (3) W59 hinge, (1) W19 latch, (1) W28 inside release, (1) 1095 closer
   FINISH: .040 stucco aluminum / 24 ga. stainless steel 430 (magnetic) liners
   KICKPLATES: 36" high, .125 aluminum diamond tread (leaf & frame, ext. & int.)
   w/ (1) ea. Terminal J-box @ interior w/ concealed conduit
   w/ (1) ea. 14" x 14" heated (-20F) Norfab view window (12 3/4" x 12 3/4" viewing area) (50W, 120V, 0.42A)
   w/ (1) ea. 12 ga. smooth stainless steel 304 #2B threshold
   w/ Electrical components to be pre-wired
   1 ea. Kason 1832 heated air vent (23W, 120V, .2A)

NOTE: MANUFACTUR RECOMMENDS REPLACING DOOR AND ADDING HEATED AIR VENT FOR CONVERSION TO FREEZER

U. ITEM 21 - SPARE NO. <Spare No.>

V. ITEM 22 - SPARE NO. <Spare No.>

W. ITEM 23 - NESTING PAN RACK (3 REQ'D)
1. New Age Model 1330Z
2. "Z" Type Nesting Bun Pan Rack, mobile, full height, open sides, with slides for (30) 18" x 26" pans, slides on approximately 2" centers, front loading, (4) 5" platform casters, NSF, Made in USA, (standard factory lead time)
3. Lifetime warranty against rust & corrosion, 5 year workmanship and material defects warranty, standard
4. Model CL-B Caster Lock, for 5" platform caster (pair)

X. ITEM 24 - CART, UTILITY/BUSSING (2 REQ'D)
1. Metro Model MY2030-24BL
2. Quick Ship - myCart™ Series Utility Cart, (2) shelves, open base, 34-3/8"W x 23-7/16"D x 35-1/2"H, heavy duty plastic shelf, with (4) swivel/resilient tread casters, 2-shelf cart has a 300 lb. capacity per unit, black, NSF

Y. ITEM 25 - REACH-IN REFRIGERATOR (3 REQ'D)
1. Continental Refrigerator Model D2RNSA
2. Designer Line Refrigerator, reach-in, two-section, self-contained refrigeration, stainless steel exterior, aluminum interior, stainless steel front, standard depth cabinet, full-height stainless steel doors, cylinder locks, electronic control with digital display, hi-low alarm, 6" stainless steel legs, R290 hydrocarbon refrigerant, 1/3 HP, cETLus, NSF, ENERGY STAR®
3. Standard warranty (for the United States & Canada Only): 7 year parts, labor, and compressor
4. 115v/60/1-ph, 6.9 amps, cord, NEMA 5-15P, standard
5. Left door hinged on left & right door hinged on right, standard
6. Model 50205-4 Casters, swivel, with brakes set of 4 (5" height)

Z. ITEM 26 - SERVING COUNTER, COLD FOOD (1 REQ'D)
1. Eagle Group Model DCS4-CFUR
2. Director's Choice® Refrigerated Cold Pan Unit, self-contained, 64"W x 30"D x 34"H, 4-5/8"D (4) 12"x 20" pan size with 3/4" drain & valve, 16/304 stainless steel top, welded 1-1/2" square tubular open base with apron on operator side, laminated front panel holly berry red (Wilsonart D307-60) 5" poly casters (2 with brake), 304 stainless steel construction, 120v/60/1-ph, 6.8 amps, 1/4 HP, NEMA 5-15P, 6' cord & plug, NSF, UL
3. Model -S Stainless steel front panel for 64" long Director's Choice® models

4. Model DCS4-DSG-BST Directors Choice® Decorative Deluxe Sneeze Guard, buffet style, 64"W x 42"D x 14"H, single tier, double-sided, clear polycarbonate front & end panels, stainless steel frame, factory installed, NSF
5. Stainless steel finish for sneeze guard
6. 2 ea Model DC4-TS-TS Tray Slide, 64"W x 11-1/2"D, 1" square tubular 3-bar, stainless steel, stainless steel drop brackets, for Director's Choice® models
7. 2 ea Model DC4-WS-ST End Shelf, 18"W, 18/304 stainless steel, stainless steel drop brackets

SECTION 12 24 00 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior manual roller shades.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
2. Do not install shades until final surface finishes and painting are complete.

1.3 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

B. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

C. Selection Samples: Include fabric samples in full range of available colors and patterns.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.

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1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.6 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.7 WARRANTY

A. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Fabric: One year.
   3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.1 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades WT-1
   1. Products:
      a. Inpro Corporation; WebbLock Roller Shade, Basis of Design
      b. Approved Equal
   2. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Drop Position: Regular roll.
      b. Roll Direction: Roll down, closed position is at window sill.
      c. Mounting: Window jamb mounted - inside, between jambs.
      d. Size: As indicated on drawings.
      e. Fabric: As indicated on drawings
   3. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
      a. Material: Stamped steel.
   4. Roller Tubes: As required for type of shade operation.
      a. Material: Extruded aluminum, clear anodized finish.
      b. Size: 1.75" diameter

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c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.

5. Hembars: Designed to maintain bottom of shade straight and flat.
6. Manual Operation for Interior Shades:
   a. Cordless, using an internal lift spring.
7. Accessories:
   a. Headbox: S aluminum, concealed with fabric valance.
   b. End Tips: Black plastic break away end tips.
   c. Interior Side Channels: As required for light sealing room-darkening shade applications.
   d. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

C. Roller Shades WT-2
1. Products:
   a. Inpro Corporation; H100 SoloMount Clutch Shade, Basis of Design,
   b. Approved Equal
2. Description - Interior Roller Shades: Manually operated roller shade utilizing clutch mechanism and continuous loop chain, ceiling/jamb mount.
3. Clutch Mechanism: Heavy duty clutch with integrated stainless steel chain diverter and positive engagement with mounting bracket.
4. Roller Tube: Sized to support fabric without deflection; diameter 1.25 inch.
5. Shade Fabric: WT 14x, 3% openness, Color as selected by Architect from manufacturer full range
6. Fascia: Aluminum, color as selected by architect from manufacturers full range.
7. Hem Bar: Sealed aluminum hem bar, color coordinated with system.
8. Stainless steel bead drive chain
9. Child Safety Tension Device
10. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.

2.2 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: As recommended in writing by manufacturer.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

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B. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

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

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.5 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 12 36 00 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters

1.2 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

1.3 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

D. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.4 SUBMITTALS

A. See Section 01 33 00 Submittals for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

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F. Installation Instructions: Manufacturer's installation instructions and recommendations.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

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

PART 2 PRODUCTS

2.1 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Sinks and Bowls: Integral castings; minimum 3/4 inch wall thickness; comply with IAPMO Z124.
      b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
   3. Other Components Thickness: 1/2 inch, minimum.
   4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
   5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

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2.2 MATERIALS

A. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.

B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

2.3 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
      a. Rout a 1/8 inch drip groove at underside of exposed overlapping edges, set back 1/2 inch from face of edge.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Wall-Mounted Counters: Provide skirts and aprons as indicated on drawings, finished to match.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

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

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

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

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3.3 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Seal joint between back/end splashes and vertical surfaces.

3.4 CLEANING

A. Clean countertops surfaces thoroughly.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 13 90 00 – INSTITUTIONAL SOFFIT SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. The soffit/cover system shall incorporate a concealed snap-lock connection, which, once assembled, renders the cover essentially irremovable with the use of ordinary tools.

1.2 SUBMITTALS

A. Submit copies of Manufacturer's specifications, installation instructions, and product data.

1.3 QUALITY ASSURANCE

A. Manufacturer: Furnish components from one (1) manufacturer with a minimum of ten (10) years of experience in the fabrication of institutional soffit covers utilizing systems, materials, and techniques as herein specified.

B. Installer: Firm with not less than three (3) years of successful experience in the installation of systems similar to those required by this project and acceptable to Manufacturer of the system.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All materials shall be protected during fabrication, shipment, site storage, and erection to prevent damage from other trades. Store soffit/cover system and components inside a well-ventilated area, and protected from the weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

1.5 JOB CONDITIONS

A. Coordinate installation of soffit/cover system with all other trades.

PART 2 - PRODUCTS

2.1 MATERIAL

A. A factory-fabricated steel cover support system with concealed surface-mounted attachment clamps, in dimensions as shown on the drawings for concealment of Fire Sprinkler Systems, Piping, HVAC, Conduit, Wiring or Cable

B. Acceptable Manufacturers
   1. JG Innovations, Inc.
   2. In-Ex Systems, Inc.
   3. Approved Equal

C. Support/Attachment Devices

1. Spring steel shield clips of the size recommended by manufacturer, for securement of the cover. Clips shall be produced from 21 Gauge minimum zinc-plated spring steel and shall have a reverse curvature design such that the clips soundly secure the soffit from easy removal. Each clip must be demonstrated as being able to resist a force of 200 lbs. uplift at the free end. Test results shall be available upon request.

D. Soffit/Cover

1. The soffit/cover shall be smooth in appearance and shall be made of 16 Gauge A60/G90 galvannealed steel, with a paint grip finish and factory painted of a color to be selected by Architect. The cover shall have a snap-lock interfacing with the clips such that once assembled, it is rendered virtually irremovable with the use of ordinary tools.

2. The soffit and related fittings shall be factory painted with epoxy polyester hybrid powder coating of a color to be selected by Architect from manufacturers full range of colors. Matching touch-up paint shall be supplied to the owner by the manufacturer.

3. Cover manufacturer shall be staffed with a licensed engineer having a minimum of five years experience with such systems.

4. The soffit/cover shall be sized in accordance with requirements to accommodate the specific application size as specified by the project documents, specifications and blue prints, provided to the cover manufacturer prior to bid date.

5. L-Shield soffit profile for sidewall installations and/or U-Shield soffit profile for sidewall and/or pendant installations respectively.

6. Cover joints shall be interlocking integral joints with provision for securement utilizing stainless steel rivets. Rivet spacing shall be at no greater than 2” intervals along the joint and positioned at a distance no greater than 1” from the end of the overlapping section. External couplings will NOT be allowed.

7. Cover design shall include a roll-formed "groove" at the interfacing of the cover and the adjacent construction surface to facilitate the application of sealant/adhesive compounds and enhance the security of such compounds from dislodging.

E. Accessories

1. The system shall include tamper-resistant end caps, prefabricated corners, wall flanges, couplings, and other items, which may be necessary to complete the system, and shall be installed in accordance with manufacturer recommendations.

2. Spare Parts - The installing contractor shall supply the owner with quantities of spare parts equal to a minimum of five percent (5%) of the total quantities of each soffit part utilized in this installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of system shall be in strict accordance with approved shop drawings and manufacturer's printed instructions.

1. If used to conceal fire sprinkler systems, the sprinkler contractor/engineer must determine the piping and sprinkler layout, including sprinkler head locations and pipe support locations (based on pipe manufacturer's specifications). Indicate areas on drawings where cover system is to be used.

2. Select appropriate fasteners for the substrate encountered to adequately secure the pipe and cover system.

3. To insure that the cover is linear and snug-fitting when installed, it is imperative that its support devices are anchored squarely and firmly against the structural surface in a straight line.

4. All penetrations to the soffit/cover system must be field cut to prevent misalignment with intended protrusion. The exceptions to this are that access doors will be factory furnished and installed and perforations, if required, for ventilation purposes will be factory perforated.

5. Guidelines for installation of modular soffit/cover system shall be supplied by the manufacturer of said system and the installing contractor shall adhere to the manufacturer's guidelines.

6. All field cut ends and scratches shall be "touched up" (spray or brush) with a matching paint.

7. Manufacturer shall supply on-site installation instruction, upon installer’s request, by a qualified installation instructor for a minimum of one day for the project start-up (1,500 lineal feet minimum.)

8. The completed installation shall be visibly searched for voids between the interfacing of the cover and construction surface. Voids shall be sealed with a color matching siliconized caulk or urethane caulk.

SECTION 21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

C. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Labels, Signs and Tags:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Brady Corporation.
      b. Brimar Industries, Inc.
      c. Seton Identification Products.

2.2 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

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

2.3 WARNING SIGNS AND LABELS

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

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

E. Pipe-Label Colors:
1. Background Color: Safety Red.
2. Letter Color: White.

2.5 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032 inch or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain or S-hook.
3. Valve-Tag Size: 1-1/2” round.

B. Valve Schedules: Provide for each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit a view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes.

3.5 VALVE-TAG, SIGN AND LABEL INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.
   1. Valve-Tag Application Schedule: Tag valves as follows:
      a. Fire-Suppression Standpipe.
      b. Wet-Pipe Sprinkler System.
      c. Dry-Pipe Sprinkler System.

B. Attach warning signs and labels to equipment and other items where required.

END OF SECTION 21 05 53

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pipes, fittings, and specialties.
   2. Cover system for sprinkler piping.
   3. Specialty valves.
   4. Sprinklers.
   5. Alarm devices.
   6. Pressure gages.

1.3 DEFINITIONS

A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.

B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Design Data:
1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

B. Fire-hydrant flow test report.

C. Field Test Reports:
1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

1.9 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13.
   2. NFPA 13R.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. High-Pressure Piping System Component: Listed for 250-psig minimum working pressure.

D. Delegated Design: Engage a qualified professional to design wet-pipe sprinkler systems.
   1. Refer to information on drawings for any fire hydrant flow test records.
   2. Sprinkler system design shall be approved by authorities having jurisdiction.
      a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
      b. Sprinkler Occupancy Hazard Classifications:
         1) Automobile Parking Areas: Ordinary Hazard, Group 1.
         2) Building Service Areas: Ordinary Hazard, Group 1.
         3) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
         4) General Storage Areas: Ordinary Hazard, Group 1.
         5) Laundries: Ordinary Hazard, Group 1.
         6) Libraries except Stack Areas: Light Hazard.
         7) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
         8) Office and Public Areas: Light Hazard.
         9) Residential Living Areas: Light Hazard.
   3. Minimum Density for Automatic-Sprinkler Piping Design:
      a. Residential (Dwelling) Occupancy: 0.05 gpm over 400-sq. ft. area.
      b. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
      c. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
      d. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   4. Maximum Protection Area per Sprinkler: According to UL listing.
   5. Maximum Protection Area per Sprinkler:
      a. Residential Areas: 400 sq. ft.

b. Office Spaces: 225 sq. ft.
c. Storage Areas: 130 sq. ft.
d. Mechanical Equipment Rooms: 130 sq. ft.
e. Electrical Equipment Rooms: 130 sq. ft.
f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A53/A53M, Type E. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Black-Steel Pipe: ASTM A135/A135M; ASTM A795/A795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 (DN 125) and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 (DN 150 to DN 250), plain end.

D. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.

E. Uncoated-Steel Couplings: ASTM A865/A865M, threaded.

F. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

G. Malleable- or Ductile-Iron Unions: UL 860.

H. Cast-Iron Flanges: ASME 16.1, Class 125.

I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick.
a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

J. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

K. Grooved-Joint, Steel-Pipe Appurtenances:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include but are not limited to the following:
a. Anvil International
b. Shurjoint Piping Products

c. Tyco Fire and Building Products
d. Victaulic Company.

2. Pressure Rating: 250-psig minimum.
3. Grooved-End Fittings for Steel Piping: ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:
1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
2. High-Pressure Piping Specialty Valves: 250-psi minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

2.4 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:
1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum [300 psig].
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:
1. Standard: UL 199.
2. Pressure Rating: 175 psig.

3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:
1. Standard: UL 1474.
2. Pressure Rating: 250-psig minimum.
3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
4. Size: Same as connected piping.
5. Length: Adjustable.
6. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:
1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum.
4. Size: Same as connected piping, for sprinkler.

2.5 SPRINKLERS

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. Globe Fire Sprinkler Corporation
2. Reliable Automatic Sprinkler Co., Inc.
3. Tyco Fire and Building Products
4. Victaulic Company
5. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum.

F. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Finishes: Chrome plated, bronze and painted.

H. Special Sprinklers: Tamper Resistant.

I. Special Coatings: Corrosion-resistant paint.

J. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, one piece, flat or plastic, white finish, one piece, flat.
2. Sidewall Mounting: Chrome-plated steel or plastic, white finish, one piece, flat.

2.6 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Flow Indicators:
1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

C. Pressure Switches:
1. Standard: UL 346.
2. Type: Electrically supervised water-flow switch with retard feature.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:
1. Standard: UL 346.
2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.

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

2.7 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 2-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0- to 250-psig minimum.

D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-distribution main.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-distribution piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

M. Fill sprinkler system piping with water.

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
   1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
   1. Install valves in vertical position for proper direction of flow, in main supply to system.
   2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
   3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   4. Energize circuits to electrical equipment and devices.
   5. Coordinate with fire-alarm tests. Operate as required.
   6. Coordinate with fire-pump tests. Operate as required.
   7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.11 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
   1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger shall be one of the following:
   1. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
   2. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

END OF SECTION 21 13 13

SECTION 21 13 16 - DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Pipes, fittings, and specialties.
2. Specialty valves.
3. Sprinkler specialty pipe fittings.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Dry-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For dry-pipe sprinkler systems.
1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For dry-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

C. Fire-hydrant flow test report.

D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For dry-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
      a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional.

1.9 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Opening of sprinklers releases compressed air and permits water pressure to open dry-pipe valve. Water then flows into piping and discharges from opened sprinklers.

2.2 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Sprinkler system design shall be approved by authorities having jurisdiction.
   1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   2. Sprinkler Occupancy Hazard Classifications:
      a. Automobile Parking Areas: Ordinary Hazard, Group 1.
      b. Building Service Areas: Ordinary Hazard, Group 1.
      c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      d. General Storage Areas: Ordinary Hazard, Group 1.
      e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   3. Minimum Density for Automatic-Sprinkler Piping Design:
      a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
      b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
      c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
      d. Special Occupancy Hazard: As determined by authorities having jurisdiction.
   4. Maximum Protection Area per Sprinkler: According to UL listing.
   5. Maximum Protection Area per Sprinkler:
      a. Office Spaces: 225 sq. ft.
      b. Storage Areas: 130 sq. ft.
      c. Mechanical Equipment Rooms: 130 sq. ft.
      d. Electrical Equipment Rooms: 130 sq. ft.
      e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
   6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
      a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
      b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

2.3 STEEL PIPE AND FITTINGS

A. Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

C. Galvanized-Steel Couplings: ASTM A 865/A 865M, threaded.

D. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable- or Ductile-Iron Unions: UL 860.

F. Cast-Iron Flanges: ASME B16.1, Class 125.

G. Plain-End-Pipe Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn or screwed retainer pin to secure pipe in fitting.

H. Grooved-Joint, Steel-Pipe Appurtenances:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anvil International.
      b. Shurjoint Piping Products.
      c. Tyco Fire & Building Products LP.
      d. Victaulic Company.
   2. Pressure Rating: 175-psig minimum.
   3. Galvanized, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
   4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.4 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:
   1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Dry-Pipe Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Globe Fire Sprinkler Corporation.
b. Reliable Automatic Sprinkler Co., Inc. (The).
c. Tyco Fire & Building Products LP.
d. Victaulic Company.
e. Viking Corporation.
2. Standard: UL 260.
3. Design: Differential-pressure type.
4. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
5. Air-Pressure Maintenance Device:
a. Standard: UL 260.
b. Type: Automatic device to maintain minimum air pressure in piping.
c. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig outlet pressure.
6. Air Compressor:
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) Gast Manufacturing Inc.
2) General Air Products, Inc.
3) Viking Corporation.
b. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
c. Motor Horsepower: Fractional.
d. Power: 120-V ac, 60 Hz, single phase.

G. Automatic (Ball Drip) Drain Valves:
1. Standard: UL 1726.
2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.5 SPRINKLER PIPING SPECIALTIES

A. General Requirements for Dry-Pipe System Fittings: UL listed for dry-pipe service.

B. Branch Outlet Fittings:
1. Standard: UL 213.

2. Pressure Rating: 175-psig minimum.
3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

C. Flow Detection and Test Assemblies:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

D. Branch Line Testers:
1. Standard: UL 199.
2. Pressure Rating: 175-psig minimum.
3. Body Material: Brass.
4. Size: Same as connected piping.
5. Inlet: Threaded.
6. Drain Outlet: Threaded and capped.
7. Branch Outlet: Threaded, for sprinkler.

E. Sprinkler Inspector's Test Fittings:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum.
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

2.6 SPRINKLERS

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. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire & Building Products LP.
4. Venus Fire Protection Ltd.
5. Victaulic Company.
6. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

D. Automatic Sprinklers with Heat-Responsive Element:
   1. Nonresidential Applications: UL 199.
   2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

E. Sprinkler Finishes: Bronze.

F. Special Sprinklers: Tamper Resistant.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:
   1. Standard: UL 464.
   2. Type: Vibrating, metal alarm bell.
   3. Size: 8-inch minimum diameter.
   4. Finish: Red-enamel factory finish, suitable for outdoor use.
   5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Pressure Switches:
   1. Standard: UL 346.
   2. Type: Electrically supervised water-flow switch with retard feature.
   3. Components: Single-pole, double-throw switch with normally closed contacts.
   4. Design Operation: Rising pressure signals water flow.

D. Valve Supervisory Switches:
   1. Standard: UL 346.
   2. Type: Electrically supervised.
   3. Components: Single-pole, double-throw switch with normally closed contacts.
   4. Design: Signals that controlled valve is in other than fully open position.
   5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

2.8 PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 2-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0- to 250-psig minimum.

D. Label: Include "WATER" or "AIR/WATER" label on dial face.

E. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 WATER-SUPPLY CONNECTIONS

A. Connect sprinkler piping to building's interior water-main piping. Comply with requirements for interior piping in Section 221116 "Domestic Water Piping."

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-main piping.

C. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 and smaller.

E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

G. Install sprinkler piping with drains for complete system drainage.

H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

I. Install automatic (ball drip) drain valves to drain piping between fire department connections and check valves. Drain to floor drain or to outside building.

J. Connect compressed-air supply to dry-pipe sprinkler piping.

K. Connect air compressor to the following piping and wiring:
   1. Pressure gages and controls.
   2. Electrical power system.
   3. Fire-alarm devices, including low-pressure alarm.

L. Install alarm devices in piping systems.

M. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements in NFPA 13.

N. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

O. Drain dry-pipe sprinkler piping.

P. Pressurize and check dry-pipe sprinkler system piping, air-pressure maintenance devices and air compressors.

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
   1. Install valves in vertical position for proper direction of flow, in main supply to system.
   2. Install dry-pipe valves with trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
      a. Install air compressor and compressed-air-supply piping.

3.6 SPRINKLER INSTALLATION

A. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   4. Energize circuits to electrical equipment and devices.
   5. Start and run air compressors.
   6. Coordinate with fire-alarm tests. Operate as required.
   7. Coordinate with fire-pump tests. Operate as required.
   8. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.11 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Standard-pressure, dry-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:
   1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.

D. Standard-pressure, dry-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:

1. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.12 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:
   1. Rooms without Ceilings: Upright sprinklers.
   2. Rooms with Suspended Ceilings: Dry pendent, recessed, flush, and concealed sprinklers as indicated.
   3. Rooms with inmate access: Tamper Resistant
   4. Wall Mounting: Dry sidewall sprinklers.
   5. Spaces Subject to Freezing: Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.
   1. Upright and Sidewall Sprinklers: Bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 16

SECTION 21 31 13 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Horizontally mounted, single-stage, split-case fire pumps.
   2. Fire-pump accessories and specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire pumps, motor drivers, and fire-pump accessories and specialties.
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of fire pump, from manufacturer.

C. Source quality-control reports.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 20.

B. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

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

2.2 GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS

A. Description: Factory-assembled and -tested fire-pump and driver unit.

B. Base: Fabricated and attached to fire-pump and driver unit, with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.3 HORIZONTALLY MOUNTED, SINGLE-STAGE, SPLIT-CASE FIRE PUMPS

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. Pentair/Aurora
   2. Peerless
   3. SPP Pumps

B. Pump:
   1. Standard: UL 448, for split-case pumps for fire service.
   2. Casing: Axially split case, cast iron, with ASME B16.1 pipe-flange connections.
   3. Impeller: Double suction, cast bronze, statically and dynamically balanced, and keyed to shaft.
   4. Wear Rings: Replaceable bronze.
   5. Shaft and Sleeve: Alloy steel shaft with bronze sleeve.
      a. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.

b. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.

6. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base.

C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard.

D. Driver:
1. Standard: UL 1004A.
2. Type: Electric motor; NEMA MG 1, polyphase Design B.

2.4 FIRE-PUMP ACCESSORIES AND SPECIALTIES

A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing.

B. Circulation Relief Valves: UL 1478, brass, spring loaded; for installation in pump discharge piping.

C. Relief Valves:
1. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

D. Inlet Fitting: Eccentric tapered reducer at pump suction inlet.

E. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.

F. Discharge Cone: Closed or open type.

G. Hose Valve Manifold Assembly:
1. Standard: Comply with requirements in NFPA 20.
2. Header Pipe: ASTM A53/A53M, Schedule 40, galvanized steel, with ends threaded according to ASME B1.20.1.
3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
4. Automatic Drain Valve: UL 1726.
5. Manifold:
a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
c. Nipples: ASTM A53/A53M, Schedule 40, galvanized-steel pipe, with ends threaded according to ASME B1.20.1.
d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
e. Escutcheon Plate: Brass or bronze; rectangular.
f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
g. Exposed Parts Finish: Rough brass.

h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

6. Manifold:
   a. Test Connections: Comply with UL 405; however, provide outlets without clappers instead of inlets.
   b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
   c. Escutcheon Plate: Brass or bronze; round.
   d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
   e. Exposed Parts Finish: Rough brass.
   f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

2.5 GROUT

A. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."
   1. Verification of Performance: Rate fire pumps according to UL 448.

B. Fire pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment bases and anchorage provisions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Install fire-pump suction and discharge piping equal to or larger than sizes required by NFPA 20.

C. Support piping and pumps separately, so weight of piping does not rest on pumps.

D. Install valves that are same size as connecting piping.

E. Install pressure gages on fire-pump suction and discharge flange pressure-gage tappings. Comply with requirements for pressure gages specified in section 211313 "Wet-Pipe Sprinkler Systems."

F. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

G. Install sensors.

H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

I. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

A. Align split-case pump and driver shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment according to HI 1.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Section 211313 "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Section 262933 "Controllers for Fire-Pump Drivers."

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 the following tests and inspections with the assistance of a factory-authorized service representative.
   1. After installing components, assemblies, and equipment, including controller, test for compliance with requirements.
   2. Test according to NFPA 20 for acceptance and performance testing.
   3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

F. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps.

END OF SECTION 21 31 13

SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Grout.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

C. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078400 "Firestopping."

END OF SECTION 22 05 17

SECTION 22 051 8 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Escutcheons.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

D. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for exposed piping penetrations of walls, ceilings, and finished floors for all new plumbing fixtures.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

END OF SECTION 22 05 18

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of valve.
   1. Certification that products comply with NSF 61and NSF 372.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and soldered ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B16.18 for solder-joint connections.
   6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valves in Insulated Piping:
   1. Include 2-inch stem extensions.
   2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
   3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Threaded or Soldered Ends:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. Dezurick
      c. Jamesbury
      d. Jenkins Valves; a Crane Co. brand
      e. WATTS
      f. Or equal as approved by Professional
   2. Description:
      a. Standard: MSS SP-110 or MSS SP-145.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Forged brass.
      e. Ends: Threaded and soldered.
      f. Seats: PTFE.
      g. Stem: Stainless steel.
      h. Ball: Stainless steel, vented.
      i. Port: Full.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. Dezurick
      c. Jamesbury
      d. Jenkins Valves; a Crane Co. brand
      e. WATTS
      f. Or equal as approved by Professional
   2. Description:
      a. Standard: MSS SP-110 or MSS-145.
      b. CWP Rating: 600 psig.
      c. Body Design: Two piece.
      d. Body Material: Bronze.
      e. Ends: Threaded or soldered.
      f. Seats: PTFE.
      g. Stem: Stainless steel.
      h. Ball: Stainless steel, vented.
      i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

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

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Brass ball valves, two-piece with full port and stainless steel trim. Provide with solder-joint ends.
   2. Bronze ball valves, two-piece with full port and stainless steel trim. Provide with solder-joint ends.

END OF SECTION 22 05 23.12

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal hanger-shield inserts.
   4. Fastener systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
   3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL HANGER-SHIELD INSERTS

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. Carpenter & Paterson, Inc.
   2. ERICO International Corporation
   3. National Pipe Hanger Corporation
   4. Or equal as approved by Professional.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
   1. Indoor Applications: Zinc-coated steel.

2.5 MATERIALS

A. Carbon Steel: ASTM A1011/A1011M.

B. Structural Steel: ASTM A36/A36M carbon-steel plates, shapes, and bars; black and galvanized.

C. Stainless Steel: ASTM A240/A240M.

D. Grout: ASTM C1107/C1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078400 "Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A36/A36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install lateral bracing with pipe hangers and supports to prevent swaying.

H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

I. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:
1. Attach clamps and spacers to piping.
   a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal hanger-shield inserts may be used.
3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal hanger-shield inserts may be used.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

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

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use thermal hanger-shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   3. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   4. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

6. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
7. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
8. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
9. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 ACTION SUBMITTALS

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

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTUTERS

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. Brady Corporation
   2. Brimar Industries, Inc.
   3. Seton Identification Products
   4. Or equal as approved by Professional.

2.2 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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

2.3 WARNING SIGNS AND LABELS

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

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

E. Fasteners: Stainless-steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. Label Content: Include caution and warning information plus emergency notification instructions.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Tag size: 1-1/2 inches round.
   3. Fasteners: Brass wire-link chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:
1. Domestic Cold Water Piping:
   a. Background: Safety green.
   b. Letter Colors: White.
2. Domestic Hot Water, Hot Water Return, and Tempered Water Piping:
   a. Background: Safety yellow.
   b. Letter Colors: Black.
3. Sanitary Waste and Vent and Storm Drainage Piping:
   a. Background Color: Safety green.
   b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

END OF SECTION 22 05 53

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Domestic recirculating hot-water piping.
   4. Roof drains and rainwater leaders.
   5. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.4 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.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

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

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

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

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

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

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

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Armstrong Insulation
      c. Owens Corning.
   2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ-SSL.
   3. 850 deg F.
   4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
   5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Childers Brand; H. B. Fuller Construction Products
      b. Eagle Bridges - Marathon Industries
      c. Foster Brand; H. B. Fuller Construction Products
      d. Mon-Eco Industries, Inc.
      e. Or equal as approved by Professional.
   2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Childers Brand; H. B. Fuller Construction Products
      b. Eagle Bridges - Marathon Industries
      c. Foster Brand; H. B. Fuller Construction Products
      d. Or equal as approved by Professional
   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. PVC Jacket Adhesive: Compatible with PVC jacket.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dow Corning Corporation
      b. Johns Manville; a Berkshire Hathaway company
      c. P.I.C. Plastics, Inc.
      d. Speedline Corporation
      e. Or equal as approved by Professional
   2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 SEALANTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering projects that may be incorporated into the Work include, but are not limited to, the following:
   1. Childers Brand; H.B. Fuller Construction Products

2. Eagle Bridges-Marathon Industries
3. Foster Brand; H.B. Fuller Construction Products
4. Or equal as approved by Professional.

B. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

C. Service Temperature Range: Minus 100 to plus 300 degF.

D. Color: White or gray.

E. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 FACTORY-APPLIED JACKETS

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

2.5 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Johns Manville; a Berkshire Hathaway company
b. P.I.C. Plastics, Inc.
c. Proto Corporation
d. Speedline Corporation
e. Or equal as approved by Professional.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.6 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
    1. Width: 3 inches.
    2. Thickness: 11.5 mils.
    3. Adhesion: 90 ounces force/inch in width.
    4. Elongation: 2 percent.
    5. Tensile Strength: 40 lbf/inch in width.
    6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
    1. Width: 2 inches.
    2. Thickness: 6 mils.
    3. Adhesion: 64 ounces force/inch in width.
    4. Elongation: 500 percent.
    5. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
    1. Width: 2 inches.
    2. Thickness: 3.7 mils.
    3. Adhesion: 100 ounces force/inch in width.
    4. Elongation: 5 percent.
    5. Tensile Strength: 34 lbf/inch in width.

2.7 SECUREMENTS

A. Bands:
    1. Stainless Steel: ASTM A240/A240M, Type 304; 0.015 inch thick, 3/4 inch wide with closed seal.
    2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.

B. Wire: 0.062-inch soft-annealed, stainless steel.

2.8 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. McGuire Manufacturing
   b. Plumberex Specialty Products, Inc.
   c. Truebro
   d. Zurn Industries, LLC
   e. Or equal as approved by Professional.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Truebro
   b. McGuire Manufacturing
   c. Zurn Industries, LLC
   d. Or equal as approved by Professional.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
   3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
   a. For below-ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078400 "Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 "Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter,

whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

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

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as that of straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
1. NPS 1-1/4 and Smaller: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
2. NPS 1-1/2 and Larger: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot, Recirculated Hot, and Tempered Water:
1. NPS 1-1/4 and Smaller: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
2. NPS 1-1/2 and Larger: Insulation shall be the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

C. Horizontal Stormwater and Overflow:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:
1. All Pipe Sizes: Insulation shall be one of the following:
a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
1. Insulation shall be as provided with protective shielding pipe cover kits.

3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. None.

D. Piping, Exposed:
   1. PVC: 20 mils thick.

END OF SECTION 22 07 19

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Transition fittings.
3. Dielectric fittings.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.4 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

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

B. Potable-water piping and components shall comply with NSF 14, NSF 61 Annex G, and NSF 372.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

E. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

2.4 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Standard: ASSE 1079.
2. Pressure Rating: 125 psig minimum at 180 deg F.
3. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Standard: ASSE 1079.
2. Factory-fabricated, bolted, companion-flange assembly.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Nonconducting materials for field assembly of companion flanges.
2. Pressure Rating: 150 psig.
3. Gasket: Neoprene or phenolic.
4. Bolt Sleeves: Phenolic or polyethylene.
5. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Standard: IAPMO PS 66.
2. Electroplated steel nipple complying with ASTM F 1545.
3. Pressure Rating and Temperature: 300 psig at 225 deg F.
4. End Connections: Male threaded or grooved.
5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install shutoff valve immediately upstream of each dielectric fitting.

C. Install domestic water piping level without pitch and plumb.

D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

G. Install piping to permit valve servicing.

H. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

M. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for copper piping with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping within 12 inches of each fitting.

D. Support vertical runs of copper piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

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

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

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. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller.
2. Drain Duty: Hose-end drain valves.

END OF SECTION 221116

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Temperature-actuated, water mixing valves.
   2. Outlet boxes.
   3. Water-hammer arresters.
   4. Flexible connectors.

B. Related Requirements:
   1. Section 224500 "Emergency Plumbing Fixtures" for water tempering equipment.
   2. Section 224713 "Drinking Fountains" for water filters for water coolers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G.

B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 unless otherwise indicated.

2.3 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Honeywell
      b. Lawler Manufacturing Company, Inc.
      c. Leonard Valve Company.
      d. Powers.
   2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
   3. Pressure Rating: 125 psig minimum unless otherwise indicated.
   4. Body: Bronze body with corrosion-resistant interior components.
   5. Temperature Control: Adjustable.
   6. Inlets and Outlet: Threaded.
   7. Finish: Rough or chrome-plated bronze.
   8. Tempered-Water Setting: 110 deg F.

2.4 OUTLET BOXES

A. Clothes Washer Outlet Boxes:
   1. Mounting: See drawings.
   2. Material and Finish: Stainless-steel box and faceplate.
   3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
   4. Supply Shutoff Fittings: NPS 1/2 gate or ball valves and NPS 1/2 copper, water tubing.
   5. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
   6. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
   7. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

2.5 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Josam Company.

b. Smith, Jay R. Mfg. Co.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.
e. Or equal as approved by the Professional.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.6 FLEXIBLE CONNECTORS

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. Flex-Hose Co., Inc.
2. Flexicraft Industries
3. Flex-Weld, Inc.
4. Metraflex Company (The)
5. Proco Products, Inc.
6. Universal Metal Hose.
7. Or equal as approved by the Professional.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Temperature-Actuated, Water Mixing Valves: Install with shutoff valves on inlets and outlets.

B. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

C. Water-Hammer Arresters: Install in water piping according to PDI-WH 201.

3.2 CONNECTIONS

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

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

C. Comply with requirements for grounding equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Thermostatic, water mixing valves.
   2. Outlet boxes.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 22 11 19

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Hubless, cast-iron soil pipe and fittings.
   2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 FIELD CONDITIONS

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

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10-foot head of water .

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fernco Inc.
      b. MIFAB, Inc.
      c. Tyler Pipe; a subsidiary of McWane Inc
   2. Standards: ASTM C 1277 and CISPI 310.
   3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Clamp-All Corp.
      b. MIFAB, Inc.
      c. Tyler Pipe; a subsidiary of McWane Inc.
   2. Standards: ASTM C 1277 and ASTM C 1540.
   3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Cast-Iron, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. MG Piping Products Company.
   2. Standard: ASTM C 1277.
   3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
   1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
   2. Unshielded, Nonpressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1) Fernco Inc.
   2) Froet Industries LLC.
   3) Mission Rubber Company, LLC; a division of MCP Industries.
   4) Plastic Oddities.
b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. End Connections: Same size as and compatible with pipes to be joined.
e. Sleeve Materials:
   1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
   2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
   3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cascade Waterworks Mfg. Co.
      2) Mission Rubber Company, LLC; a division of MCP Industries.
   b. Standard: ASTM C 1460.
   c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. End Connections: Same size as and compatible with pipes to be joined.

B. Dielectric Fittings:
1. Dielectric Unions:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Capitol Manufacturing Company.
      2) Watts; a Watts Water Technologies company.
      3) Wilkins.
      4) Zurn Industries, LLC.
   b. Description:
      1) Standard: ASSE 1079.
      2) Pressure Rating: 150 psig.
      3) End Connections: Solder-joint copper alloy and threaded ferrous.
2. Dielectric Nipples:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Elster Perfection Corporation.
      2) Grinnell Mechanical Products.
      3) Precision Plumbing Products.
      4) Victaulic Company.
   b. Description:

1) Standard: IAPMO PS 66.
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install piping to allow application of insulation.

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
   1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
   2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
      a. Straight tees, elbows, and crosses may be used on vent lines.
   3. Do not change direction of flow more than 90 degrees.
   4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
      a. Reducing size of waste piping in direction of flow is prohibited.

J. Lay buried building waste piping beginning at low point of each system.
   1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
   2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
   3. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

M. Install engineered soil and waste and vent piping systems as follows:
   1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
   2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
   3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

N. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
      a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
      b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
   2. Install drains in sanitary waste gravity-flow piping.
      a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.
   1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.
   1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.
   1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in ODs.
   2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
   3. In Aboveground Force Main Piping: Fitting-type transition couplings.
   4. In Underground Force Main Piping:
      a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
      b. NPS 2 and Larger: Pressure transition couplings.

B. Dielectric Fittings:
   1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
   2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
   3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
   3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
   4. Vertical Piping: MSS Type 8 or Type 42, clamps.
   5. Install individual, straight, horizontal piping runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical runs of cast iron soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 CONNECTIONS

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

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:
   1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
   5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
   a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
   a. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
   a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
   b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
   c. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
   a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
   b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
   c. Air pressure must remain constant without introducing additional air throughout period of inspection.
   d. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:
   1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coiupled joints.

C. Aboveground, vent piping NPS 4 and smaller shall be the following:
   1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:
   1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cleanouts.
   2. Miscellaneous sanitary drainage piping specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Josam Company.
      b. Smith, Jay R. Mfg. Co.

c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, cast-iron plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Cast-Iron Exposed Floor Cleanouts:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Josam Company.
b. Smith, Jay R. Mfg. Co.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Spigot.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with setscrews or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Medium Duty.
13. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Josam Company.
b. Smith, Jay R. Mfg. Co.
c. Watts; a Watts Water Technologies company.
d. Zurn Industries, LLC.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:
a. Brass.
b. Countersunk head.
c. Drilled and threaded for cover attachment screw.
d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access: Round, flat, chrome-plated brass or stainless steel cover plate cover plate with screw.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:
   1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
   2. Size: Same as connected waste piping.
      a. NPS 2: 4-inch- minimum water seal.
      b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Floor-Drain, Trap-Seal Primer Fittings:
   1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
   2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.
   1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. *Install deep-seal traps on floor drains and other waste outlets, if indicated.

F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.

2. Size: Same as floor drain inlet.

G. Install wood-blocking reinforcement for wall-mounting-type specialties.

H. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Floor drains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Ligature-Resistant Cast-Iron Floor Drains:
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Whitehall Manufacturing; Morris Group International model WHFD-5RD-2NH or comparable product by one of the following:
      a. Josam Company.
      b. Zurn Industries, LLC.
   2. Standard: ASME A112.6.3.
   3. Body Material: Cast iron.
   4. Seepage flange.
   5. Anchor flange.
   6. Clamping device.
   7. Grate Material and Finish: Stainless steel.
   8. Grate Shape: Round
   9. Grate Dimension: 5 inch.
   10. Ligature-Resistant Cast Iron Floor Drain Hardware: Manufacturer's standard ligature-resistant hardware required to secure strainer grate to drain body.

B. Ligature-Resistant Linear Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Whitehall Manufacturing; Morris Group International; BestCare model WHLD-36-F or WHLD-48-F (as indicated on drawings):
   a. Josam Company.
   b. Zurn Industries, LLC.
2. Outlet: Bottom.
3. Top or Strainer Material: Type 304 stainless steel polished to a No. 4 satin finish.
4. Top Shape: Rectangular.
5. Dimensions of Top or Strainer: 2.25 inch (57 mm) width x 36 inch or 48 inch length (as indicated on drawings).
6. Flashing flange.
7. Clamping device.
8. Drain Body Material: Type 304 stainless steel.

C. Cast-Iron Floor Drains (exterior):
1. Basis-of-Design Product: Subject to compliance with requirements, provide Jay R. Smith Manufacturing; model 2280:
   a. Zurn
   b. Josam
   c. MIFAB
   d. Wade
   e. Watts.
2. Light duty, Duco cast iron floor drain engineered for installation on-grade and can support loads of less than 2,000 lbs. (900kg.). 7.5" diameter slotted cast iron grate that is hinged to a 10" square top.
3. Sediment Bucket

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:
   a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
   b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
   c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
   a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
6. Set grates of drains flush with finished surface, unless otherwise indicated.

B. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.
1. Install on support devices, so that top will be flush with adjacent surface.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19.13

SECTION 22 13 23 - SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Grease interceptors.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. PP: Polypropylene.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of plastic interceptor. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.
   1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Piping connections. Include size, location, and elevation of each.
   2. Interface with underground structures and utility services.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste interceptors to include in emergency, operation, and maintenance manuals.

1.7 FIELD CONDITIONS

A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sewer services according to requirements indicated:
   1. Notify Architect and Owner no fewer than seven days in advance of proposed interruption of service.
   2. Do not proceed with interruption of sewer services without Owner's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Schier.
   b. Josam Company.
   c. Smith, Jay R. Mfg. Co.

2.2 GREASE INTERCEPTORS

A. Plastic Grease Interceptors:

1. Standard: PDI G101 and ASME A112.14.3, for intercepting and retaining FOG from wastewater.
2. PDI Seal: Not required.
3. Body Material: Plastic.
4. Body Extension: Required where necessary for recessed or below-floor installation. Provide manufacturer’s field-cut riser system to bring cover flush with finished floor.
   a. End Connections: Threaded.
   b. Cleanout: Integral.
   c. Trapped Outlet Required: Integral.
   d. Vent Pipe Size: 2 NPS.
   e. Mounting: Recessed, flush with floor.
   f. Flow-Control Fitting: Required.
   g. Operation: Manual cleaning.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set interceptors level and plumb.

B. Install manhole risers from top of underground plastic interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface.

D. Set plastic interceptors level and plumb.

E. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.
   1. Above-Floor Installation: Set unit with bottom resting on floor unless otherwise indicated.
   2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
   3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
   4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

3.2 PIPING CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.3 IDENTIFICATION

A. Identification materials and installation:
   1. Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.
   2. Use warning tapes or detectable warning tape over ferrous piping.
   3. Use detectable warning tape over nonferrous piping and over edges of underground structures.

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Grease interceptors.

3.4 PROTECTION

A. Protect sanitary waste interceptors from damage during construction period.

B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

END OF SECTION 22 13 23

SECTION 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. PVC pipe and fittings.
   2. Specialty pipe and fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Storm Drainage Piping: 10-foot head of water.

2.2 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665; drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.
1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Solvent Cement: ASTM D 2564.
1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
1. General Requirements: Fitting or device for joining piping with small differences in ODs or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Nonpressure Transition Couplings:
a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1) Fernco Inc.
2) Mission Rubber Company, LLC; a division of MCP Industries.
3) Plastic Oddities.
b. Standard: ASTM C 1173.
c. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. Sleeve Materials:
1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Nonpressure Transition Couplings:
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cascade Waterworks Mfg. Co.
      2) Mission Rubber Company, LLC; a division of MCP Industries.
   b. Standard: ASTM C 1460.
   c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   d. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.
   1. Do not change direction of flow more than 90 degrees.

2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    a. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building piping beginning at low point of each system.
1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install piping at the following minimum slopes unless otherwise indicated:
1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm Drainage Piping: 2 percent downward in direction of flow.

M. Install aboveground PVC piping according to ASTM D 2665.

N. Install underground PVC piping according to ASTM D 2321.

O. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping.
    a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
2. Install drains in storm drainage gravity-flow piping.
    a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs.
1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

3.2 JOINT CONSTRUCTION

A. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendices.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendices.

B. Joint Restraints and Sway Bracing:
1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
   a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
   b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
   c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in ODs.
2. In Drainage Piping: Shielded, nonpressure transition couplings.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Install individual, straight, horizontal piping runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

D. Support vertical PVC piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 CONNECTIONS

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

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.
   1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
   2. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance.

E. Make connections according to the following unless otherwise indicated:
   1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
   2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.6 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
   2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
      a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.
      a. Expose work that was covered or concealed before it was tested.

3. Test Procedure:
    a. Test storm drainage piping, except outside leaders, on completion of roughing-in.
    b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
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.

C. Piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Underground storm drainage piping NPS 6 and smaller shall be the following:
1. [Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 14 13

SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - `GENERAL

1.1 SUMMARY`

A. Section Includes:
   1. Metal roof drains.
   2. Miscellaneous storm drainage piping specialties.
   3. Cleanouts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Josam Company.
      b. Marathon Roofing Products.
      c. MIFAB, Inc.
      d. Smith, Jay R. Mfg. Co.
      e. Watts; a Watts Water Technologies company.
      f. Zurn Industries, LLC.
   2. Standard: ASME A112.6.4.
   3. Body Material: Cast iron.
   4. Dimension of Body: Nominal 14-to 16-inch diameter.
   5. Combination Flashing Ring and Gravel Stop: Required.
   6. Flow-Control Weirs: Required for overflow drain.
   7. Outlet: Bottom.
   8. Extension Collars: Required.

9. Underdeck Clamp: Required.
10. Expansion Joint: Not required.
11. Sump Receiver Plate: Required.
12. Dome Material: PE.
13. Perforated Gravel Guard: Not required.
14. Vandal-Proof Dome: Required.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:
1. Standard: ASME A112.36.2M.
2. Size: Same as connected branch.
3. Body Material: No-hub, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, cast-iron plug.
5. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

B. Cast-Iron Wall Cleanouts:
1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: No-hub, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:
   a. Cast iron.
   b. Countersunk or raised head.
   c. Drilled and threaded for cover attachment screw.
   d. Size: Same as, or not more than, one size smaller than cleanout size.
5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

C. Test Tees:
1. Standard: ASME A112.36.2M and ASTM A74, ASTM A888, or CISPI 301.
2. Size: Same as connected drainage piping.
3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or no-hub, cast-iron soil-pipe test tee as required to match connected piping.
4. Closure Plug: Countersunk or raised head.
5. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.

B. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
   1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
   3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate cleanouts at base of each vertical storm piping conductor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install test tees in vertical conductors and near floor.

F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

G. Assemble channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

H. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.
   1. Comply with requirements in Section 078400 "Firestopping."

3.2 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 14 23

SECTION 22 40 00 – PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Water closets, flushometer valves, toilet seats.
2. Urinals, flushometer valves.
3. Lavatories and faucets.
4. Kitchen sinks and faucets.
5. Service basins, service sinks and faucets.
6. Supply and waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves, faucets to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Standard .
2. Crane Plumbing, L.L.C.
3. Gerber Plumbing Fixtures LLC.

4. Kohler Co.
5. Sloan Valve Company.
6. TOTO USA, INC.
7. Zurn Industries, LLC.

2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS, FLUSH VALVE

A. Water Closets: Floor mounted, bottom outlet, top spud.
   1. Bowl:
      a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
      b. Material: Vitreous china.
      c. Type: Siphon jet.
      d. Style: Flushometer valve.
      e. Height: Standard and Handicapped/elderly, complying with ICC/ANSI A117.1.
      f. Rim Contour: Elongated.
      g. Water Consumption: 1.28 gal. per flush.
      h. Spud Size and Location: NPS 1-1/2; top.
      i. Color: White.
   2. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.

2.3 WALL-MOUNTED WATER CLOSETS, FLUSH VALVE.

A. Water Closets: Wall mounted, top spud**,** accessible.
   1. Bowl:
      a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
      b. Material: Vitreous china.
      c. Type: Siphon jet.
      d. Style: Flushometer valve.
      e. Height: Standard.
      f. Rim Contour: Elongated.
      g. Water Consumption: 1.28 gal. per flush.
      h. Spud Size and Location: NPS 1-1/2; top.
   2. Support:
      a. Standard: ASME A112.6.1M.
      b. Description: Waste-fitting assembly as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.
      c. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.4 WATER CLOSET FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:

   1. Standard: ASSE 1037.

2. Minimum Pressure Rating: 125 psig.
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Style: Exposed.
7. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
8. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
9. Consumption: 1.28 gal. per flush.
10. Minimum Inlet: NPS 1.
11. Minimum Outlet: NPS 1-1/4.

2.5 TOILET SEATS

A. Toilet Seats:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Standard America.
   b. Bemis Manufacturing Company.
   c. Church Seats; Bemis Manufacturing Company.
   d. Kohler Co.
   e. Olsonite Seat Co.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Standard).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.6 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, washout.
1. Fixture:
   a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
   b. Material: Vitreous china.
   c. Type: Washout with extended shields.
   d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
   e. Water Consumption: Water saving.
   f. Spud Size and Location: NPS 3/4, top.
   g. Outlet Size and Location: NPS 2, back.

h. Color: White.

2. Waste Fitting:
   a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
   b. Size: NPS 2.
3. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.7 URINAL FLUSHOMETER VALVES

A. Solenoid-Actuator, Diaphragm Flushometer Valves:
   1. Standard: ASSE 1037.
   2. Minimum Pressure Rating: 125 psig.
   3. Features: Include integral check stop and backflow-prevention device.
   4. Material: Brass body with corrosion-resistant components.
   5. Exposed Flushometer-Valve Finish: Chrome plated.
   6. Style: Exposed.
   7. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
   8. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
   9. Consumption: 0.5 gal. per flush.
   10. Minimum Inlet: NPS 3/4.
   11. Minimum Outlet: NPS 3/4.

2.8 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Ledge back, vitreous china, wall mounted.
   1. Fixture:
      a. Standard: ASME A112.19.2/CSA B45.1.
      b. Type: For wall hanging.
      c. Nominal Size: Oval, 22 by 14 inches.
      d. Faucet-Hole Punching: Three holes, 2-inch centers.
      e. Faucet-Hole Location: Top.
      f. Color: White.
      g. Mounting Material: Chair carrier.
   2. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.

2.9 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, single-control mixing, commercial, solid-brass valve.
   1. Standard: ASME A112.18.1/CSA B125.1.
   2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
   3. Body Type: Centerset.
   4. Body Material: Commercial, solid brass.
   5. Finish: Polished chrome plate.
   6. Maximum Flow Rate: 0.5 gpm.
   7. Mounting Type: Deck, exposed.
   8. Valve Handle(s): Single lever.
   9. Spout: Rigid type.
   10. Spout Outlet: Aerator.
   11. Operation: Noncompression, manual.
   12. Drain: Not part of faucet.

2.10 LAVATORY SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Risers:
   1. NPS 3/8.
   2. Chrome-plated, soft-copper flexible tube riser.

2.11 LAVATORY WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:
   1. Size: NPS 1-1/4.
   2. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.12 KITCHEN SINKS

A. Kitchen Sinks: Single bowl, counter mounted, stainless steel.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Elkay.
   2. Just Manufacturing.
   3. Kohler Company.

C. Fixture:
   1. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
   2. Overall Dimensions: 31”x22”.
   3. Metal Thickness: 0.050 inch, 18 gauge.
   4. Drain: 3-1/2-inch crumb cup centered in bowl.
   5. Disposer: Not required.
   6. Dishwasher Air-Gap Fitting: Not required.
   7. Hot-Water Dispenser: Not required.

2.13 KITCHEN SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets: Solid brass, kitchen sink.
   1. General-Duty, Solid-Brass Faucets:
   2. Standard: ASME A112.18.1/CSA B125.1.
   3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
   4. Finish: Polished chrome plate.
   5. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
   6. Mixing Valve: Single control.
   7. Mounting: Deck, exposed.
   8. Handle(s): Lever.
   9. Spout Type: Swing, solid brass.
   10. Spout Outlet: Aerator.

2.14 SERVICE BASINS

A. Service Basins: Plastic, floor mounted.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fiat Products
      b. Zurn Industries, LLC.
   2. Fixture:

a. Standard: IAPMO/ANSI Z124.6.
b. Material: Cast polymer.
c. Nominal Size: 24 by 24 by 10 inches.
d. Tiling Flange: On two sides.
e. Rim Guard: On front top surfaces.
f. Drain: Grid with NPS 2 outlet.

3. Mounting: On floor and flush to wall.
4. Grout:
   a. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
   b. Characteristics: Nonshrink, recommended for interior and exterior applications.
   c. Design Mix: 5000-psi, 28-day compressive strength.
   d. Packaging: Premixed and factory packaged.
5. Faucet: General-Duty, Solid-Brass Faucet.
   a. Standard: ASME A112.18.1/CSA B125.1.
   b. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies.
   c. Body Type: Widespread.
   d. Body Material: Commercial, solid brass.
   e. Finish: Chrome plated.
   f. Maximum Flow Rate: 2.2 gpm.
   g. Handle(s): Lever.
   h. Mounting Type: Back/wall, exposed.
   i. Spout Type: Rigid, solid brass with wall brace.
   j. Vacuum Breaker: Required for hose outlet.
   k. Spout Outlet: Hose thread according to ASME B1.20.

2.15 SERVICE SINKS

A. Service Sinks: Enameled, cast iron, trap standard mounted.
   1. Fixture:
      a. Standard: ASME A112.19.1/CSA B45.2.
      b. Type: Service sink with back.
      c. Back: Two faucet holes.
      d. Nominal Size: 24 by 20 inches.
      e. Color: White.
      f. Mounting: NPS 3 P-trap standard with grid strainer inlet, cleanout, and floor flange.
      g. Rim Guard: On front and sides.
   2. Support: ASME A112.6.1M, Type II, sink carrier.
   3. Faucet: General-Duty, Solid-Brass Faucet.
      l. Standard: ASME A112.18.1/CSA B125.1.
      m. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings.
      n. Body Type: Widespread.
      o. Body Material: Commercial, solid brass.

p. Finish: Chrome plated.
q. Maximum Flow Rate: 2.2 gpm.
r. Handle(s): Lever.
s. Mounting Type: Back, exposed.
t. Spout Type: Rigid, solid brass.
u. Vacuum Breaker: Required for hose outlet.
v. Spout Outlet: Hose thread according to ASME B1.20.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine counters, walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:
1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Urinal Installation:
1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.
4. Install trap-seal liquid in waterless urinals.

C. Support Installation:
1. Install supports, affixed to building substrate.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install wall-mounted, back-outlet fixture supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

D. Flushometer-Valve Installation:
1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install actuators in locations that are easy for people with disabilities to reach.

4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

E. Install toilet seats on water closets.

F. Lavatory Installation:
1. Install lavatories level and plumb according to roughing-in drawings.
2. Attach supports, affixed to building substrate, for wall-mounted lavatories.
3. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
4. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories.

G. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

H. Service Basin and Service Sink Installations:
1. Install supports, affixed to building substrate, for wall-hung sinks.
2. Set floor-mounted sinks in leveling bed of cement grout.
3. Install water-supply piping with stop on each supply to each sink faucet.
   a. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
   b. Install stops in locations where they can be easily reached for operation.
4. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

I. Joint Sealing:
1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to fixtures, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust fixtures and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean fixtures and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed fixtures and fittings.

C. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 40 00

SECTION 22 46 00 - SECURITY PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Combination units.
2. Water closets.
3. Urinals.
4. Lavatories.
5. Drinking fountains.
6. Showers.
7. Supports.

1.2 DEFINITIONS

A. Accessible Service Space: Service area in secure space behind wall-mounted fixtures.

B. Back-Access Fixture: Security plumbing fixture designed to mount on wall sleeve built into wall or on wall, so installation and removal of fixture, piping, and other components are accessible only from service space behind wall.

C. Front-Access Fixture: Security plumbing fixture designed to mount on wall with installation and removal from fixture side of wall, and with piping and other components accessible only from access panel in fixture.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for security plumbing fixtures.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
1. Product Data: For water consumption.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For security plumbing fixtures and components to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Flushometer-Valve Repair Kits.
   2. Lavatory Valve Repair Kits.
   3. Shower Valve Repair Kits.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Combination Units: Back access, on floor, cabinet, with water closet and lavatory.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering; Morris Group International; Model 1415 or comparable product by one of the following:
      a. Metcraft Industries, Inc.
      b. Willoughby Industries.
   2. Material: 14 gauge minimum-thickness, Type 304 stainless steel.
   3. Finish: No. 4 satin finish on exposed surfaces.
   4. Cabinet: Provide manufacturer's standard unit shape and configuration for each model number furnished. Provide units with integral backsplash.
      a. Water-Closet Bowl Location: Centered on front of apron.
      b. Cabinet Mounting: On-floor.
   5. Accessories:
      a. Toilet-Paper Holder: Recessed; non-ADA-compliant, stainless steel located on side of apron.
      b. Ligature-resistant water-closet skirt.
      c. Hemispherical Valve Push Button: Include with ligature-resistant models.
      d. Integral shelf.
      e. Lavatory overflow.
      f. Brass valve body.
      g. Pushrod-activated valve push buttons.
      h. Fixture-mounted trim.
      i. Toilet waste cleanout fitting, no-hub.
      j. Pinned cleanout plug for cleanout fittings.
      k. Cleanout hook assembly.
      l. Metal access panel.
   6. Mounting: Provide threaded mounting points on fixture and 1/2-in. threaded rod, with nuts and washers, to bolt through wall into accessible rear chase.
   7. Water Closet:
      a. Applicable Standards:
         1) ASME A112.19.3/CSA B45.4.
         2) EPA WaterSense Specifications for High Efficiency Flushometer Water Closets.

b. Bowl:
1) Type: Elongated, with back inlet, seat surface, and integral trap.
2) Seat Surface: No. 4 satin finish on integral toilet seat.
3) Rim Height: 15 inches above finished floor.
c. Toilet Waste:
1) Wall Outlet Waste Connection (Blowout): 3 inches, plain end extended 3 inches beyond back of unit. Gasket waste flange.
d. Water Consumption: 1.28 gal. per flush.
e. Supply Pressure: 25 psig, minimum.

8. Flushometer Valve:
a. Style: Hydraulic type.
b. Push-Button Location: Standard backsplash punching on right-hand side for centered and angled right toilet bowl.
9. Toilet Flush Disabler/Overflow Prevention Device: Manual-reset type.
10. Lavatory:
a. Standard:
1) ASME A 112.19.3/CSA B45.4.
2) NSF/ANSI 61, NSF/ANSI 372.
b. Location: In top of cabinet.
c. Receptor: Provide with integral, self-draining soap depression. Provide manufacturer's standard bowl shape and configuration for each model number furnished.
d. Lavatory Water Supply Valves:
1) Pneumatic, metering type with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
2) Temperature: Separate hot and cold temperature.
e. Bubbler/Filler, Backsplash-mounted: Ligature-resistant-hemispherical bubbler. Fabricate from machined, Type 303 stainless steel.
f. Drain:
1) Ligature Resistant: Integral punched grid with concealed adapter.
g. Lavatory Waste Connection: Removable P-trap, with 1-1/2-inch (38-mm) OD plain-end, extended Combined waste.
11. Mounting: Provide threaded mounting points on fixture and 1/2-inch threaded rod, with nuts and washers to bolt through wall into accessible service space.
12. Wall Sleeve: Galvanized-steel frame with anchoring locations to allow for mounting fixture from rear. Include steel reinforcing bars.

2.2 STAINLESS STEEL WATER CLOSETS

A. Water Closets: Back access, on floor, back or floor outlet, cabinet.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering; Morris Group International, Model 1684 & 1695 or comparable product by one of the following:
a. Metcraft Industries, Inc.
b. Willoughby Industries.
2. Material: 14 gauge minimum-thickness, Type 304 stainless steel.

3. Finish: No. 4 satin finish on exposed surfaces.
4. Cabinet Mounting: On-floor.
5. Accessories:
    a. 12 gauge wall flange.
    b. Toilet waste cleanout fitting IPS 4 , no-hub.
    c. Pinned cleanout plug for cleanout fittings.
    d. Cleanout hook assembly.
    e. Flush valve through-wall connection.
    f. Toilet shipping cover.
6. Mounting: Provide threaded mounting points on fixture and 1/2-inch threaded rod with nuts and washers to bolt through wall into accessible rear chase.
7. Water Closet:
    a. Applicable Standards:
        1) ASME A112.19.3/CSA B45.4.
        2) EPA WaterSense Specifications for High Efficiency Flushometer Water Closets.
        3) ICC A117.1.
        4) U.S. Energy Policy Act of 1992 for Water Closets.
    b. Bowl:
        1) Type: Elongated, with back inlet, integral trap, and integral contoured seat surface. Seat height and centerline to adjacent wall to conform to ADA standard.
        2) Seat Surface: No. 4 satin finish on integral toilet seat.
        3) Rim Height: 15 inches above finished floor.
        4) Rim Height for ADA-Compliant Installation: 18 inches above finished floor.
    c. Toilet Waste:
        1) Floor Outlet Waste Connection (Siphon-Jet): Water-closet gasket waste flange.
    d. Water Consumption: 1.28 gal. per flush.
    e. Supply Pressure: 25 psig, minimum.
8. Flushometer Valve: Hydraulic type.
    a. Flushometer-Valve Accessories: Wall supply flush valve access panel.
9. Toilet Flush Disabler/Overflow Prevention Device: Manual-reset type.

2.3 URINALS

A. Urinals: Back access, back outlet, single.
    1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering; Morris Group International; Model LR1709FG or comparable product by one of the following:
        a. Metcraft Industries, Inc.
        b. Willoughby Industries.
    2. Material: 14 gauge thickness, Type 304 stainless steel.
    3. Finish: No. 4 satin finish on exposed surfaces, and matte finish on interior wetted surfaces.
    4. Accessories:

a. Flush valve through wall connection.
b. 12 gauge stainless steel housing.

5. Mounting: Provide threaded mounting points on fixture and 1/2-inch threaded rod with nuts and washers to bolt through wall into accessible rear chase.
6. Urinal:
   a. Applicable Standards:
      1) ASME A112.19.3/CSA B45.4.
      2) EPA WaterSense Specifications for High Efficiency Flushometer Water Closets.
      3) ICC A117.1.
      4) U.S. Energy Policy Act of 1992 for Water Closets.
   b. Bowl:
      1) Type: Washout, with back wall washdown.
      2) Rim Height for ADA-Compliant Installation: 17 inches above finished floor, straddle fixture configuration.
   c. Inlet Connection, Washout: 3/4 NPT, male spud.
   d. Back Outlet: NPS 1 1/2, threaded trap.
   e. Water Consumption, Washout Fixtures: 0.125 gal., per flush.
   f. Supply Pressure: 25 psig, minimum.
   g. Drain: Provide beehive dome, welded in place.
7. Flushometer Valve: Hydraulic type.
   a. Flushometer-Valve Accessories: Wall supply flush valve access panel.

2.4 STAINLESS STEEL LAVATORIES

A. Lavatories: Back access.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering; Morris Group International; Model LR1653 or comparable product by one of the following:
      a. Metcraft Industries, Inc.
      b. Willoughby Industries.
   2. Fixture:
      a. Applicable Standards:
         1) ASME A112.19.3/CSA B45.4.
         2) ICC A117.1.
         3) NSF/ANSI 61, NSF/ANSI 372.
      b. Material: 14 gauge minimum-thickness, Type 304 stainless steel.
      c. Finish: No. 4 satin finish on exposed surfaces.
      d. Receptor: Provide manufacturer's standard unit shape and configuration for each model number furnished. Provide units with integral soap depression and integral backsplash.
      e. Hot- and Cold-Water and Bubbler Supply Valves:
         1) Type: Pneumatic, metering type, with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
         2) Temperature: Separate hot and cold temperature.
      f. Valve Water Outlet:

1) Bubbler/Filler, Backsplash-Mounted: Ligature-resistant-hemispherical bubbler. Fabricate from machined, Type 303 stainless steel.

g. Drain:
1) Ligature Resistant: Integral punched grid with concealed adapter.

h. Waste Connection: Removable P-trap, with 1-1/2-inch OD plain-end, extended beyond back of fixture.

3. Accessories:
a. Integral shelf.
b. Lavatory overflow.
c. Brass valve body.

4. Mounting: Provide threaded mounting points on fixture and 1/2-inch threaded rod with nuts and washers to bolt through wall into accessible rear chase.

2.5 DRINKING FOUNTAINS

A. Drinking Fountains, Rear Access:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering; Morris Group International; Model LR1672 or comparable product by one of the following:
a. Metcraft Industries, Inc.
b. Willoughby Industries.

2. Fixture:
a. Applicable Standards:
1) ASME A112.19.3/CSA B45.4.
2) ICC A117.1.
3) NSF/ANSI 61, NSF/ANSI 372.

b. Material: 14 gauge minimum-thickness, Type 304 stainless steel.
c. Finish: No. 4 satin finish on exposed surfaces.
d. Receptor: Provide manufacturer's standard unit shape and configuration for each model number furnished.
e. Provide units with integral backsplash.
f. Drinking Fountain Water Supply Valve:
1) Type: Pneumatic, metering, with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
2) Temperature: Single temperature.

g. Deck-Mounted Drinking Bubbler: Provide ligature-resistant, hemispherical type. Fabricate from machined, Type 303 stainless steel.
h. Drain:
1) Ligature Resistant: Integral punched grid with concealed adapter.

i. Waste: Removable P-trap, with 1-1/4-inch OD plain-end, extended.

3. Accessories:
a. Brass valve body.

4. Mounting: Provide threaded mounting points on fixture for 1/2-inch threaded rod with nuts and washers to bolt through wall into accessible rear chase.

2.6 SHOWERS

A. Showers ADA: Front access, recessed.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering; Morris Group International; Model 1741ADAFA or comparable product by one of the following:
      a. Metcraft Industries, Inc.
      b. Willoughby Industries.
   2. Fixture:
      a. Applicable Standards:
         1) ASME A112.19.3/CSA B45.4.
         2) EPA WaterSense Specification for Showerheads.
         3) ICC A117.1.
         4) NSF/ANSI 61, NSF/ANSI 372.
      b. Material: 14 gauge minimum thickness, Type 304 stainless steel.
      c. Finish: No. 4 satin finish on exposed surfaces, and matte finish on interior wetted surfaces.
      d. Type and Configuration: Wall-mounted, front access, recessed.
      e. ADA compliant.
      f. Control Valve:
         1) Type: Pneumatic, metering, adjustable from 5 to 60 seconds, with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
         2) ASSE 1016-compliant hot and cold temperature and pressure balancing mixing valve with ligature-resistant handle.
         3) ASSE 1016-compliant hot and cold temperature and pressure balancing mixing valve with ligature-resistant handle and single temperature metering valve with push button.
         4) Fixture punched for valve furnished separately.
         5) Temperature: Separate hot and cold temperature.
      g. Shower Head, ADA-Compliant: 1.6 gpm.
         1) Shower Head, Ligature-Resistant: Ligature-resistant conical shower head.
         2) Fixed shower head at 48 inches above finished floor, in lieu of handheld shower.
      h. Soap Dish: Recessed stainless steel.
   3. Accessories:
      a. Brass valve body.
   4. Mounting: Provide vandal-resistant fasteners to attach housing panel to recessed mounting frame.
   5. Access to Internal Components: Provide removable housing panel with vandal-resistant fasteners.

B. Showers non-ADA: Front access, recessed.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Acorn Engineering; Morris Group International; Model 1741FA or comparable product by one of the following:
      a. Metcraft Industries, Inc.

b. Willoughby Industries.

2. Fixture:
   a. Applicable Standards:
      1) ASME A112.19.3/CSA B45.4.
      2) EPA WaterSense Specification for Showerheads.
      3) ICC A117.1.
      4) NSF/ANSI 61, NSF/ANSI 372.
   b. Material: 14 gauge minimum thickness, Type 304 stainless steel.
   c. Finish: No. 4 satin finish on exposed surfaces, and matte finish on interior wetted surfaces.
   d. Type and Configuration: Wall-mounted, front access, recessed.
   e. Control Valve:
      1) Type: Pneumatic, metering, adjustable from 5 to 60 seconds, with push-button actuation and individual check stops complying with ASME A112.18.1/CSA B125.1.
      2) ASSE 1016-compliant hot and cold temperature and pressure balancing mixing valve with ligature-resistant handle.
      3) ASSE 1016-compliant hot and cold temperature and pressure balancing mixing valve with ligature-resistant handle and single temperature metering valve with push button.
      4) Fixture punched for valve furnished separately.
      5) Temperature: Separate hot and cold temperature.
   f. Shower Head: 1.6 gpm.
      1) Shower Head, Ligature-Resistant: Ligature-resistant conical shower head.
   g. Soap Dish: Recessed stainless steel.
3. Accessories:
   a. Brass valve body.
4. Mounting: Provide vandal-resistant fasteners to attach housing panel to recessed mounting frame.
5. Access to Internal Components: Provide removable housing panel with vandal-resistant fasteners.

2.7 SUPPORTS

A. Type III Lavatory Carrier:
   1. `Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Jay R. Smith Mfg Co; a division of Morris Group International.
      b. Josam Company.
      c. MIFAB, Inc.
      d. Wade Drains.
      e. WATTS.
      f. Zurn Industries, LLC.
   2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install security plumbing fixtures level and plumb in accordance with roughing-in drawings.

B. Install back-access, stainless steel fixtures as follows:
1. Install wall sleeve in wall if indicated.
2. Install fixture on wall sleeve or wall, as indicated, with access from accessible service space.
3. Extend supply piping from service space to fixture.
4. Install soil and waste piping from fixture and extend into service space.
5. Install fixture trap in service space instead of below fixture drain.

C. Install fixture outlets with gasket seals.

D. Install fixtures designated "accessible" in accordance with ICC A117.1 for heights, dimensions, and clearances.

E. Seal joints between fixtures, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with requirements for water piping specified in Section 221116 "Domestic Water Piping."

C. Comply with requirements for soil and waste drainage piping specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust flushometer valves and flow-control valves on fixtures.

3.5 CLEANING AND PROTECTION

A. After installing fixtures, inspect and repair damaged finishes.

B. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 46 00

SECTION 23 05 19 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test plug kits.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of flowmeter and energy meter indicated.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum 9-inch nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
6. Window: Glass or plastic.
7. Stem: Aluminum and of length to suit installation.

a. Design for Air-Duct Installation: With ventilated shroud.
b. Design for Thermowell Installation: Bare stem.

8. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 DUCT-THERMOMETER MOUNTING BRACKETS

A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.3 THERMOWELLS

A. Thermowells:
1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Type: Stepped shank unless straight or tapered shank is indicated.
4. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
5. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
6. Bore: Diameter required to match thermometer bulb or stem.
7. Insertion Length: Length required to match thermometer bulb or stem.
8. Lagging Extension: Include on thermowells for insulated piping and tubing.
9. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
2. Case: Sealed type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Brass or stainless steel.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass or stainless-steel pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: Chlorosulfonated polyethylene synthetic self-sealing rubber.

2.7 TEST-PLUG KITS

A. Manufacturers: To match test plugs.

B. Furnish one test-plug kit containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Pressure Gage: Small, Bourdon-tube insertion type with diameter dial and probe. Dial range shall be at least 0 to 200 psig.

D. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install valve and snubber in piping for each pressure gage for fluids (except steam).

I. Install valve and syphon fitting in piping for each pressure gage for steam.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:
   1. Inlet and outlet of each hydronic coil in air-handling units.
   2. Locations shown on drawings.

L. Install pressure gages in the following locations:
   1. Discharge of each pressure-reducing valve.
   2. Suction and discharge of each pump.
   3. Locations shown on drawings.

3.2 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of gages to proper angle for best visibility.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 deg F.

B. Scale Range for Heating, Hot-Water Piping: 0 to 250 deg F.

3.4 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Chilled-Water Piping: 0 to 100 psi.

B. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

END OF SECTION 23 05 19

SECTION 23 05 23 - VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.
   2. Bronze lift check valves.
   3. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. SWP: Steam working pressure.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and weld ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded-end valves.
   2. ASME B16.18 for solder-joint connections.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Refer to HVAC valve schedule articles for applications of valves.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
   1. Gear Actuator: For quarter-turn valves NPS 6 and larger.
   2. Handlever: For quarter-turn valves smaller than NPS 6.

H. Valves in Insulated Piping:
   1. Include 2-inch stem extensions.
   2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
   3. Memory stops that are fully adjustable after insulation is applied.

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

2.2 BRONZE BALL VALVES

A. Two-Piece Bronze Ball Valves with Full Port and Bronze or Brass Trim:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Valve, Inc.
      b. Conbraco Industries, Inc.
      c. Crane; Crane Energy Flow Solutions.
      d. Hammond Valve.
      e. Lance Valves.
      f. Legend Valve & Fitting, Inc.
      g. Milwaukee Valve Company.

h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts; a Watts Water Technologies company.

2. Description:
a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

2.3 BRONZE LIFT CHECK VALVES

A. Class 125 Lift Check Valves with Bronze Disc:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Crane; Crane Energy Flow Solutions.
b. Jenkins Valves; Crane Energy Flow Solutions.
c. Stockham; Crane Energy Flow Solutions.
2. Description:
a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125 Lift Check Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Flo Fab inc.
b. Hammond Valve.
c. KITZ Corporation.
d. Milwaukee Valve Company.
e. Mueller Steam Specialty.
f. NIBCO INC.
g. Red-White Valve Corporation.
h. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: NBR or PTFE.

2.4 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Crane; Crane Energy Flow Solutions.
b. Hammond Valve.
c. Jenkins Valves; Crane Energy Flow Solutions.
d. Milwaukee Valve Company.
e. NIBCO INC.
f. Watts; a Watts Water Technologies company.
2. Description:
a. Standard: MSS SP-80, Type 3 or 4.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze or PTFE.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

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

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
1. `Swing Check Valves: In horizontal position with hinge pin level or with flow up.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:
1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.5 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Two piece, full port, bronze with brass, bronze, or stainless-steel trim.
1. Valves may be provided with solder-joint ends instead of threaded ends.
2. Bronze Swing Check Valves: [Class 125] [Class 150], nonmetallic disc.

3.6 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Two piece, full port, bronze with brass, bronze, or stainless-steel trim.
1. Valves may be provided with solder-joint ends instead of threaded ends.
2. Bronze Swing Check Valves: Class 150, nonmetallic disc.

END OF SECTION 23 05 23

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Thermal-hanger shield inserts.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Copper Pipe Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

E. 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.

F. Install lateral bracing with pipe hangers and supports to prevent swaying.

G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

J. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.3 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.4 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use copper-plated pipe hangers and copper or stainless-steel attachments for uninsulated copper piping and tubing.

F. Use thermal-hanger shield inserts for insulated piping and tubing.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Beam Clamps: For attaching to beams, channels, or angles.
   3. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   4. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb.
      b. Medium (MSS Type 32): 1500 lb.
      c. Heavy (MSS Type 33): 3000 lb.
   5. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   6. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
   7. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Install spring hangers and supports of the type indicated on the drawings at locations indicated on the drawings.

END OF SECTION 23 05 29

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Duct labels.
   5. Stencils.

PART 2 - PRODUCTS

2.1 MANUFACTUTERS

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. Brady Corporation.
   2. Brimar Industries, Inc.
   3. Seton Identification Products.

2.2 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

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

2.3 WARNING SIGNS AND LABELS

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

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

E. Fasteners: Stainless-steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. Label Content: Include caution and warning information plus emergency notification instructions.

2.4 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially or fully cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.5 STENCILS

A. Stencils for Ducts:
   1. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
   2. Stencil Paint: Exterior, gloss. Paint may be in pressurized spray-can form.

B. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
   1. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
   2. Stencil Paint: Exterior, gloss. Paint may be in pressurized spray-can form.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.5 DUCT LABEL INSTALLATION

A. Stenciled Duct Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems.
   2. Balancing Hydronic Piping Systems:
      a. Constant-flow hydronic systems.
   3. Testing, adjusting, and balancing existing systems and equipment.
   4. Control system verification.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building Automation Systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB reports.

C. Instrument calibration reports.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC, NEBB, or TABB.
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB, or TABB.
   2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB, or TABB as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

K. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:
1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
1. Airside:
   a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
   b. Duct systems are complete with terminals installed.

c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:
   a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
   b. Piping is complete with terminals installed.
   c. Water treatment is complete.
   d. Systems are flushed, filled, and air purged.
   e. Strainers are pulled and cleaned.
   f. Control valves are functioning per the sequence of operation.
   g. Shutoff and balance valves have been verified to be 100 percent open.
   h. Pumps are started and proper rotation is verified.
   i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
   j. Variable-frequency controllers' startup is complete and safeties are verified.
   k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports that comply with requirements in Section 233300 "Air Duct Accessories."
   3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

C. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

D. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

E. Verify that motor starters are equipped with properly sized thermal protection.

F. Check dampers for proper position to achieve desired airflow path.

G. Check for airflow blockages.

H. Check condensate drains for proper connections and functioning.

I. Check for proper sealing of air-handling-unit components.

J. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
      d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
1. Check liquid level in expansion tank.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.

4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

3.7 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.
   1. Measure total water flow.
      a. Position valves for full flow through coils.
      b. Measure flow by main flow meter, if installed.
      c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
   2. Measure pump TDH as follows:
      a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      c. Convert pressure to head and correct for differences in gage heights.
      d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
      e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
   3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.
   1. Measure flow in main and branch pipes.
   2. Adjust main and branch balance valves for design flow.
   3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
   1. Measure flow at terminals.
   2. Adjust each terminal to design flow.
   3. Re-measure each terminal after it is adjusted.
   4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
   5. Perform temperature tests after flows have been balanced.

D. For systems with pressure-independent valves at terminals:
   1. Measure differential pressure and verify that it is within manufacturer's specified range.
   2. Perform temperature tests after flows have been verified.

E. For systems without pressure-independent valves or flow-measuring devices at terminals:
   1. Measure and balance coils by either coil pressure drop or temperature method.

2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

F. Verify final system conditions as follows:
1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

G. Verify that memory stops have been set.

3.8 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:
1. Verify temperature control system is operating within the design limitations.
2. Verify that controller set points are as indicated.
3. Verify the operation of valve and damper actuators.
4. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate-drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
   1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
   2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
   3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
   4. Balance each air outlet.

3.10 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
   2. Air Outlets and Inlets: Plus or minus 10 percent.
   3. Heating-Water Flow Rate: Plus or minus 10 percent.
   4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

3.12 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
   1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
   2. Include a list of instruments used for procedures, along with proof of calibration.
   3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
   1. Pump curves.
   2. Fan curves.
   3. Manufacturers' test data.

4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data
2. Motor Data
3. Test Data (Indicated and Actual Values)

E. Apparatus-Coil Test Reports:
1. Coil Data
2. Test Data (Indicated and Actual Values)

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data
2. Motor Data
3. Test Data (Indicated and Actual Values)

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

H. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
   1. Unit Data
   2. Test Data (Indicated and Actual Values)

I. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
   1. Unit Data
   2. Test Data (Indicated and Actual Values)

J. Instrument Calibration Reports:
   1. Report Data:
      a. Instrument type and make.
      b. Serial number.
      c. Application.
      d. Dates of calibration.

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed return located in unconditioned space.

B. Related Sections:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after sealing and pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

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

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. 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.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. CertainTeed Corporation.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.

d. Manson Insulation Inc.
e. Owens Corning.

2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CertainTeed Corporation.
   b. Johns Manville; a Berkshire Hathaway company.
   c. Knauf Insulation.
   d. Manson Insulation Inc.
   e. Owens Corning.
2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. 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:
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

2.4 SEALANTS

A. FSK Jacket Flashing Sealants:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 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.

2.6 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.

2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.7 SECUREMENTS

A. Bands:
1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
2. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
   a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. 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. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   b. Spindle: Zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
   c. Adhesive-backed base with a peel-off protective cover.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

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

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.8 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Keep insulation materials dry during application and finishing.

F. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

G. Install insulation with least number of joints practical.

H. 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.

I. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

J. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
   a. For below ambient services, apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Seal penetrations through fire rated assemblies with fire stopping sealant.

C. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

2. Seal penetrations through fire rated assemblies with fire stopping sealant.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 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 on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Impale insulation over pins and attach speed washers.
      f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
   5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
   6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not overcompress insulation during installation.
      e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
   4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
      a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
      b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
   5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
   6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 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 air.

4. Indoor, exposed return air.

B. Items Not Insulated:
1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Concealed, round and flat-oval duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

C. Concealed, rectangular duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. Ft nominal density.

D. Concealed plenum insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

E. Exposed, round and flat-oval duct insulation shall be the following:
1. Mineral-Fiber Pipe and Tank: 1-1/2 inches thick.

F. Exposed, rectangular, supply-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

G. Exposed plenum insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

3.8 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Ducts and Plenums, Concealed or Exposed:
1. None.

3.9 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Ducts and Plenums, Concealed:
   1. Aluminum, Smooth or Stucco Embossed: 0.020 inch thick.

C. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
   1. Aluminum, Smooth or Stucco Embossed: 0.020 inch thick.

D. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
   1. Aluminum, Smooth or Stucco Embossed with 1-1/4-Inch-Deep Corrugations: 0.032 inch thick.

END OF SECTION 23 07 13

SECTION 230719 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Chilled-water piping.
   2. Heating hot-water piping.
   3. Refrigerant suction and hot-gas piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

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

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

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

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

C. Products that come 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Aeroflex USA, Inc.
      b. Armacell LLC.
      c. K-Flex USA.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Johns Manville; a Berkshire Hathaway company.
   b. Knauf Insulation.
   c. Manson Insulation Inc.
   d. Owens Corning.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Aeroflex USA, Inc.
   b. Armacell LLC.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. K-Flex USA.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.
   d. Mon-Eco Industries, Inc.
2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Childers Brand; H. B. Fuller Construction Products.
   b. Eagle Bridges - Marathon Industries.
   c. Foster Brand; H. B. Fuller Construction Products.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Dow Corning Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. P.I.C. Plastics, Inc.
d. Speedline Corporation.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following::
a. Foster Brand; H. B. Fuller Construction Products.
b. Knauf Insulation.
c. Vimasco Corporation.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller Construction Products.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
   1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Foster Brand; H. B. Fuller Construction Products.
      c. Vimasco Corporation.
   3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
   4. Service Temperature Range: 0 to plus 180 deg F.
   5. Color: White.

2.5 SEALANTS

A. Joint Sealants:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following::
      a. Childers Brand; H. B. Fuller Construction Products.
      b. Eagle Bridges - Marathon Industries.
      c. Foster Brand; H. B. Fuller Construction Products.
   2. Materials shall be compatible with insulation materials, jackets, and substrates.
   3. Permanently flexible, elastomeric sealant.
   4. Service Temperature Range: Minus 100 to plus 300 deg F.
   5. Color: White or gray.
   6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following::
      a. Johns Manville; a Berkshire Hathaway company.
      b. P.I.C. Plastics, Inc.
      c. Proto Corporation.
      d. Speedline Corporation.
   2. Adhesive: As recommended by jacket material manufacturer.
   3. Color: White.
   4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
      a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Polyguard Products, Inc.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
   1. Width: 3 inches.
   2. Thickness: 11.5 mils.
   3. Adhesion: 90 ounces force/inch in width.
   4. Elongation: 2 percent.
   5. Tensile Strength: 40 lbf/inch in width.
   6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2 inches.
   2. Thickness: 6 mils.
   3. Adhesion: 64 ounces force/inch in width.

4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:
1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with closed seal.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

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

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Seal penetrations at fire rated assemblies.

D. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations at fire rated assemblies.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
   3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
   4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
   5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
   6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
   7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
   8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
   9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape

insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
   1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
   2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
   3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
   4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
   5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

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

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.9 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Do not field paint aluminum or stainless-steel jackets.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Underground piping.
   2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:
   1. All Pipe Sizes: Insulation shall be the following:
      a. Flexible Elastomeric: 1/2 inch thick.

B. Chilled Water, above 40 Deg F:
   1. 1-1/4 inches and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.
   2. 1-1/2 inches and Larger: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.

C. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
   1. 1-1/4 inches and Smaller: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I: 1-1/2 inches thick.
   2. 1-1/2 inches and Larger: Insulation shall be the following:
      a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.

D. Refrigerant Suction and Hot-Gas Piping:
   1. 1-1/4” and smaller: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.

2. 1-1/2 inches and Larger: Insulation shall be the following:
   a. Flexible Elastomeric: 1-1/2 inches thick.

E. Refrigerant Suction and Hot-Gas Flexible Tubing:
1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, Exposed:
1. PVC: 20 mils thick.

C. Pipe Fittings: PVC Fitting covers.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
1. None.
2. Aluminum, Smooth or Stucco Embossed: 0.020 inch thick.

END OF SECTION 23 07 19

SECTION 23 09 23 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. DDC system for monitoring and controlling of HVAC systems.
2. Delivery of selected control devices to equipment and systems manufacturers for factory installation and to HVAC systems installers for field installation.

1.3 DEFINITIONS

A. Algorithm: A logical procedure for solving a recurrent mathematical problem. A prescribed set of well-defined rules or processes for solving a problem in a finite number of steps.

B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.

C. BACnet Specific Definitions:
1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data over and services over a network.
2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
3. BACnet/IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
4. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.
5. PICS (Protocol Implementation Conformance Statement): Written document that identifies the particular options specified by BACnet that are implemented in a device.

D. Binary: Two-state signal where a high signal level represents ON" or "OPEN" condition and a low signal level represents "OFF" or "CLOSED" condition. "Digital" is sometimes used interchangeably with "Binary" to indicate a two-state signal.

E. Controller: Generic term for any standalone, microprocessor-based, digital controller residing on a network, used for local or global control. Three types of controllers are indicated: Network Controller, Programmable Application Controller, and Application-Specific Controller.

F. Control System Integrator: An entity that assists in expansion of existing enterprise system and support of additional operator interfaces to I/O being added to existing enterprise system.

G. COV: Changes of value.

H. DDC System Provider: Authorized representative of, and trained by, DDC system manufacturer and responsible for execution of DDC system Work indicated.

I. Distributed Control: Processing of system data is decentralized and control decisions are made at subsystem level. System operational programs and information are provided to remote subsystems and status is reported back. On loss of communication, subsystems shall be capable of operating in a standalone mode using the last best available data.

J. DOCSIS: Data-Over Cable Service Interface Specifications.

K. E/P: Voltage to pneumatic.

L. Gateway: Bidirectional protocol translator that connects control systems that use different communication protocols.

M. HLC: Heavy load conditions.

N. I/O: System through which information is received and transmitted. I/O refers to analog input (AI), binary input (BI), analog output (AO) and binary output (BO). Analog signals are continuous and represent control influences such as flow, level, moisture, pressure, and temperature. Binary signals convert electronic signals to digital pulses (values) and generally represent two-position operating and alarm status. "Digital," (DI and (DO), is sometimes used interchangeably with "Binary," (BI) and (BO), respectively.

O. I/P: Current to pneumatic.

P. LAN: Local area network.

Q. LNS: LonWorks Network Services.

R. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

S. Mobile Device: A data-enabled phone or tablet computer capable of connecting to a cellular data network and running a native control application or accessing a web interface.

T. Modbus TCP/IP: An open protocol for exchange of process data.

U. MS/TP: Master-slave/token-passing, IEE 8802-3. Datalink protocol LAN option that uses twisted-pair wire for low-speed communication.

V. MTBF: Mean time between failures.

W. Network Controller: Digital controller, which supports a family of programmable application controllers and application-specific controllers, that communicates on peer-to-peer network for transmission of global data.

X. Network Repeater: Device that receives data packet from one network and rebroadcasts it to another network. No routing information is added to protocol.

Y. Peer to Peer: Networking architecture that treats all network stations as equal partners.

Z. POT: Portable operator's terminal.

AA. PUE: Performance usage effectiveness.

BB. RAM: Random access memory.

CC. RF: Radio frequency.

DD. Router: Device connecting two or more networks at network layer.

EE. Server: Computer used to maintain system configuration, historical and programming database.

FF. TCP/IP: Transport control protocol/Internet protocol.

GG. UPS: Uninterruptible power supply.

HH. USB: Universal Serial Bus.

II. User Datagram Protocol (UDP): This protocol assumes that the IP is used as the underlying protocol.

JJ. VAV: Variable air volume.

KK. WLED: White light emitting diode.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at a location determined by the County after the submission of the initial shop drawings to review the comments of the engineer and the County prior to final approval of the drawings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product include the following:
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   3. Product description with complete technical data, performance curves, and product specification sheets.
   4. Installation, operation and maintenance instructions including factors effecting performance.
   5. Bill of materials of indicating quantity, manufacturer, and extended model number for each unique product.
      a. DDC controllers.
      b. Enclosures.
      c. Electrical power devices.
      d. Accessories.
      e. Instruments.
      f. Control dampers and actuators.
      g. Control valves and actuators.
   6. When manufacturer's product datasheets apply to a product series rather than a specific product model, clearly indicate and highlight only applicable information.
   7. Each submitted piece of product literature shall clearly cross reference specification and drawings that submittal is to cover.

B. Shop Drawings:
   1. General Requirements:
      a. Include cover drawing with Project name, location, Owner, Architect, Contractor and issue date with each Shop Drawings submission.
      b. Include a drawing index sheet listing each drawing number and title that matches information in each title block.
      c. Drawings Size: 11x17

   2. Include plans, elevations, sections, and mounting details where applicable.
   3. Include details of product assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   4. Schematic drawings for each controlled HVAC system indicating the following:
      a. I/O points labeled with point names shown. Indicate instrument range, normal operating set points, and alarm set points. Indicate fail position of each damper and valve, if included in Project.
      b. I/O listed in table format showing point name, type of device, manufacturer, model number, and cross-reference to product data sheet number.
      c. A graphic showing location of control I/O in proper relationship to HVAC system.

d. Wiring diagram with each I/O point having a unique identification and indicating labels for all wiring terminals.
e. Unique identification of each I/O that shall be consistently used between different drawings showing same point.
f. Elementary wiring diagrams of controls for HVAC equipment motor circuits including interlocks, switches, relays and interface to DDC controllers.
g. Narrative sequence of operation.
h. Graphic sequence of operation, showing all inputs and output logical blocks.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For DDC system to include in emergency, operation and maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace products that fail in materials or workmanship within specified warranty period.
1. Failures shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner.
2. Include updates or upgrades to software and firmware if necessary to resolve deficiencies.
a. Install updates only after receiving Owner's written authorization.
3. Warranty service shall occur during normal business hours and commence within 24 hours of Owner's warranty service request.
4. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DDC SYSTEM MANUFACTURERS

A. As provided by NRG

2.2 DDC SYSTEM DESCRIPTION

A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.
1. DDC system shall consist of a high speed, peer-to-peer network of distributed DDC controllers, operator interfaces, and software.

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

2.3 DDC CONTROLLERS

A. DDC system shall consist of a combination of network controllers, programmable application controllers and application-specific controllers to satisfy performance requirements indicated.

B. DDC controllers shall perform monitoring, control, energy optimization and other requirements indicated.

C. DDC controllers shall use a multitasking, multiuser, real-time digital control microprocessor with a distributed network database and intelligence.

D. Each DDC controller shall be capable of full and complete operation as a completely independent unit and as a part of a DDC system wide distributed network.

E. Environment Requirements:
1. Controller hardware shall be suitable for the anticipated ambient conditions.

F. Power and Noise Immunity:
1. Controller shall operate at 90 to 110 percent of nominal voltage rating and shall perform an orderly shutdown below 80 percent of nominal voltage.
2. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios with up to 5 W of power located within 36 inches (900 mm) of enclosure.

G. DDC Controller Spare I/O Point Capacity: Include spare I/O point capacity for each controller as follows:
1. Network Controllers:
   a. 20 percent of each AI, AO, BI, and BO point connected to controller.
2. Programmable Application Controllers:
   a. 20 percent of each AI, AO, BI, and BO point connected to controller.
3. Application-Specific Controllers:
   a. 10 percent of each AI, AO, BI, and BO point connected to controller.

H. Maintenance and Support: Include the following features to facilitate maintenance and support:
1. Mount microprocessor components on circuit cards for ease of removal and replacement.
2. Means to quickly and easily disconnect controller from network.
3. Means to quickly and easily access connect to field test equipment.
4. Visual indication that controller electric power is on, of communication fault or trouble, and that controller is receiving and sending signals to network.

I. Input and Output Point Interface:
1. Hardwired input and output points shall connect to network, programmable application and application-specific controllers.

2. Input and output points shall be protected so shorting of point to itself, to another point, or to ground will not damage controller.
3. Input and output points shall be protected from voltage up to 24 V of any duration so that contact will not damage controller.
4. AIs:
    a. AIs shall include monitoring of low-voltage (zero- to 10-V dc), current (4 to 20 mA) and resistance signals from thermistor and RTD sensors.
    b. AIs shall be compatible with, and field configurable to, sensor and transmitters installed.
    c. Controller AIs shall perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.
    d. Signal conditioning including transient rejection shall be provided for each AI.
    e. Capable of being individually calibrated for zero and span.
    f. Incorporate common-mode noise rejection of at least 50 dB from zero to 100 Hz for differential inputs, and normal-mode noise rejection of at least 20 dB at 60 Hz from a source impedance of 10000 ohms.
5. AOs:
    a. Controller AOs shall perform analog-to-digital (A-to-D) conversion with a minimum resolution of 8 bits or better to comply with accuracy requirements indicated.
    b. Output signals shall have a selectable range of 4-20 mA dc or 0-10Vdc as required to include proper control of output device.
    c. Capable of being individually calibrated for zero and span.
    d. AOs shall not exhibit a drift of greater than 0.4 percent of range per year.
6. BIs:
    a. Controller BIs shall accept contact closures and shall ignore transients of less than 5-ms duration.
    b. Isolation and protection against an applied steady-state voltage of up to 180-V ac peak.
    c. BIs shall include a wetting current of at least 12 mA to be compatible with commonly available control devices and shall be protected against effects of contact bounce and noise.
    d. BIs shall sense "dry contact" closure without external power (other than that provided by the controller) being applied.
    e. Pulse accumulation input points shall comply with all requirements of BIs and accept up to 10 pulses per second for pulse accumulation. Buffer shall be provided to totalize pulses. Pulse accumulator shall accept rates of at least 20 pulses per second. The totalized value shall be reset to zero on operator's command.
7. BOs:
    a. Controller BOs shall include relay contact closures or triac outputs for momentary and maintained operation of output devices.
        1) Relay contact closures shall have a minimum duration of 0.1 second. Relays shall include at least 180 V of isolation. Electromagnetic interference suppression shall be provided on all output lines to limit transients to non-damaging levels. Minimum contact rating shall be 1 A at 24-V ac.
        2) Triac outputs shall include at least 180 V of isolation. Minimum contact rating shall be 1 A at 24-V ac.

b. BOs shall include for two-state operation or a pulsed low-voltage signal for pulse-width modulation control.
c. BOs shall be selectable for either normally open or normally closed operation.
d. Include tristate outputs (two coordinated BOs) for control of three-point floating-type electronic actuators without feedback.
e. There shall be no use of three-point floating devices.

2.4 ENCLOSURES

A. General Enclosure Requirements:
1. House each controller and associated control accessories in an enclosure. Enclosure shall serve as central tie-in point for control devices such as switches, transmitters, transducers, power supplies and transformers.
2. Do not house more than one controller in a single enclosure.
3. Include enclosure door with key locking mechanism. Key locks alike, for all enclosures and include one pair of keys per enclosure.
4. Equip doors of enclosures housing controllers and components with analog or digital displays with windows to allow visual observation of displays without opening enclosure door.
5. Individual wall-mounted single-door enclosures shall not exceed 36 inches wide and 48 inches high.
6. Individual wall-mounted double-door enclosures shall not exceed 60 inches wide and 36 inches high.
7. Freestanding enclosures shall not exceed 36 inches wide and 72 inches high.
8. Include wall-mounted enclosures with brackets suitable for mounting enclosures to wall or freestanding support stand as indicated.
9. Supply each enclosure with a complete set of as-built schematics, wiring diagrams and product literature located in a pocket on inside of door.

B. Internal Arrangement:
1. Internal layout of enclosure shall group and protect pneumatic, electric, and electronic components associated with a controller, but not an integral part of controller.
2. Arrange layout to group similar products together.
3. Include a barrier between line-voltage and low-voltage electrical and electronic products.
4. Factory or shop install products, tubing, cabling and wiring complying with requirements and standards indicated.
5. Terminate field cable and wire using heavy-duty terminal blocks.
6. Include spare terminals, equal to not less than 20 percent of used terminals.
7. Include spade lugs for stranded cable and wire.
8. Install a maximum of two wires on each side of a terminal.
9. Include enclosure field power supply with a toggle-type switch located at entrance inside enclosure to disconnect power.
10. Include enclosure with a line-voltage nominal 20-A GFCI duplex receptacle for service and testing tools. Wire receptacle on hot side of enclosure disconnect switch and include with a 5-A circuit breaker.
11. Mount products within enclosure on removable internal panel(s).

12. Include products mounted in enclosures with engraved, laminated phenolic nameplates (black letters on a white background). The nameplates shall have at least 1/4-inch high lettering.
13. Route tubing, cable and wire located inside enclosure within a raceway with a continuous removable cover.
14. Label each end of cable, wire and tubing in enclosure following an approved identification system that extends from field I/O connection and all intermediate connections throughout length to controller connection.
15. Size enclosure internal panel to include at least 25 percent spare area on face of panel.

C. Environmental Requirements:
1. Evaluate temperature and humidity requirements of each product to be installed within each enclosure.
2. Calculate enclosure internal operating temperature considering heat dissipation of all products installed within enclosure and ambient effects (solar, conduction and wind) on enclosure.
3. Where required by application, include temperature-controlled electrical heat to maintain inside of enclosure above minimum operating temperature of product with most stringent requirement.
4. Where required by application, include temperature-controlled ventilation fans with filtered louver(s) to maintain inside of enclosure below maximum operating temperature of product with most stringent requirement.
5. Include temperature-controlled cooling within the enclosure for applications where ventilation fans cannot maintain inside temperature of enclosure below maximum operating temperature of product with most stringent requirement.
6. Where required by application, include humidity-controlled electric dehumidifier or cooling to maintain inside of enclosure below maximum relative humidity of product with most stringent requirement and to prevent surface condensation within enclosure.

D. Wall-Mounted, NEMA 250, Type 1:
1. Enclosure shall be NRTL listed according to UL 50 or UL 50E.
2. Construct enclosure of steel, not less than:
   a. Enclosure size less than 24 in.: 0.053 in. thick.
   b. Enclosure size 24 in. and larger: 0.093 in. thick.
3. Finish enclosure inside and out with polyester powder coating that is electrostatically applied and then baked to bond to substrate.
   a. Exterior color shall be ANSI 61 gray.
   b. Interior color shall be ANSI 61 gray.
4. Hinged door full size of front face of enclosure and supported using:
   a. Enclosures sizes less than 36 in. tall: Multiple butt hinges.
   b. Enclosures sizes 36 in.tall, and larger: Continuous piano hinges.
5. Removable internal panel with a white polyester powder coating that is electrostatically applied and then baked to bond to substrate.
   a. Size less than 24 in.: Perforated steel, 0.053 in. thick.
   b. Size 24 in. and larger: Solid steel, 0.093 in. thick.
6. Internal panel mounting hardware, grounding hardware and sealing washers.
7. Grounding stud on enclosure body.

8. Thermoplastic pocket on inside of door for record Drawings and Product Data.

E. Wall Mounted NEMA 250, Types 4 and 12:
1. Enclosure shall be NRTL listed according to UL 508A.
2. Seam and joints are continuously welded and ground smooth.
3. Where recessed enclosures are indicated, include enclosures with face flange for flush mounting.
4. Externally formed body flange around perimeter of enclosure face for continuous perimeter seamless gasket door seal.
5. Single-door enclosure sizes up to 60 inches tall by 36 inches wide.
6. Double-door enclosure sizes up to 36 inches tall by 60 inches wide.
7. Construct enclosure of steel, not less than the following:
   a. Size Less Than 24 Inches: 0.053 inch thick.
   b. Size 24 Inches and Larger: 0.067 inch thick.
8. Finish enclosure with polyester powder coating that is electrostatically applied and then baked to bond to substrate.
   a. Exterior color shall be ANSI 61 gray.
   b. Interior color shall be ANSI 61 gray.
9. Corner-formed door, full size of enclosure face, supported using multiple concealed hinges with easily removable hinge pins.
   a. Sizes through 24 Inches Tall: Two hinges.
   b. Sizes between 24 Inches through 48 Inches Tall: Three hinges.
   c. Sizes Larger 48 Inches Tall: Four hinges.
10. Double-door enclosures with overlapping door design to include unobstructed full-width access.
    a. Single-door enclosures 48 inches and taller, and all double-door enclosures, with three-point (top, middle and bottom) latch system.
11. Removable internal panel with a white polyester powder coating that is electrostatically applied and then baked to bond to substrate.
    a. Size Less Than 24 Inches: perforated steel, 0.053 inch thick.
    b. Size 24 Inches and Larger: Solid steel, 0.093 inch thick.
12. Internal panel mounting studs with hardware, grounding hardware, and sealing washers.
13. Grounding stud on enclosure body.
14. Thermoplastic pocket on inside of door for record Drawings and Product Data.

F. Accessories:
1. Bar handle with keyed cylinder lock set.

2.5 RELAYS

A. General-Purpose Relays:
1. Relays shall be heavy duty and rated for at least 10 A at 250-V ac and 60 Hz.
2. Relays shall be either double pole double throw (DPDT) or three-pole double throw, depending on the control application.
3. Use a plug-in-style relay with an eight-pin octal plug for DPDT relays and an 11-pin octal plug for three-pole double-throw relays.

4. Construct the contacts of either silver cadmium oxide or gold.
5. Enclose the relay in a clear transparent polycarbonate dust-tight cover.
6. Relays shall have LED indication and a manual reset and push-to-test button.
7. Performance:
    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Pickup Time: 15 ms or less.
    d. Dropout Time: 10 ms or less.
    e. Pull-in Voltage: 85 percent of rated voltage.
    f. Dropout Voltage: 50 percent of nominal rated voltage.
    g. Power Consumption: 2 VA.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F (Minus 40 to 46 deg C).
8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
9. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
10. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.

B. Multifunction Time-Delay Relays:
1. Relays shall be continuous duty and rated for at least 10 A at 240-V ac and 60 Hz.
2. Relays shall be DPDT relay with up to eight programmable functions to provide on/off delay, interval and recycle timing functions.
3. Use a plug-in-style relay with either an 8- or 11-pin octal plug.
4. Construct the contacts of either silver cadmium oxide or gold.
5. Enclose the relay in a dust-tight cover.
6. Include knob and dial scale for setting delay time.
7. Performance:
    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Timing Ranges: Multiple ranges from 0.1 seconds to 100 minutes.
    d. Repeatability: Within 2 percent.
    e. Recycle Time: 45 ms.
    f. Minimum Pulse Width Control: 50 ms.
    g. Power Consumption: 5 VA or less at 120-V ac.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F (Minus 40 to 46 deg C).
8. Equip relays with coil transient suppression to limit transients to non-damaging levels.
9. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
10. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.

C. Latching Relays:
1. Relays shall be continuous duty and rated for at least 10 A at 250-V ac and 60 Hz.
2. Relays shall be either DPDT or three-pole double throw, depending on the control application.
3. Use a plug-in-style relay with a multibladed plug.
4. Construct the contacts of either silver cadmium oxide or gold.

5. Enclose the relay in a clear transparent polycarbonate dust-tight cover.
6. Performance:
    a. Mechanical Life: At least 10 million cycles.
    b. Electrical Life: At least 100,000 cycles at rated load.
    c. Pickup Time: 15 ms or less.
    d. Dropout Time: 10 ms or less.
    e. Pull-in Voltage: 85 percent of rated voltage.
    f. Dropout Voltage: 50 percent of nominal rated voltage.
    g. Power Consumption: 2 VA.
    h. Ambient Operating Temperatures: Minus 40 to 115 deg F (Minus 40 to 46 deg C).
7. Equip relays with coil transient suppression to limit transients to non-damaging levels.
8. Plug each relay into an industry-standard, 35-mm DIN rail socket. Plug all relays located in control panels into sockets that are mounted on a DIN rail.
9. Relay socket shall have screw terminals. Mold into the socket the coincident screw terminal numbers and associated octal pin numbers.

D. Current Sensing Relay:
1. Monitors ac current.
2. Independent adjustable controls for pickup and dropout current.
3. Energized when supply voltage is present and current is above pickup setting.
4. De-energizes when monitored current is below dropout current.
5. Dropout current is adjustable from 50 to 95 percent of pickup current.
6. Include a current transformer, if required for application.
7. House current sensing relay and current transformer in its own enclosure. Use NEMA 250, Type 12 enclosure for indoors and NEMA 250, Type 4 for outdoors.

E. Combination On-Off Status Sensor and On-Off Relay:
1. Description:
    a. On-off control and status indication in a single device.
    b. LED status indication of activated relay and current trigger.
    c. Closed-Open-Auto override switch located on the load side of the relay.
2. Performance:
    a. Ambient Temperature: Minus 30 to 140 deg F (Minus 34 to 60 deg C).
    b. Voltage Rating: Single-phase loads rated for 300-V ac. Three-phase loads rated for 600-V ac.
3. Status Indication:
    a. Current Sensor: Integral sensing for single-phase loads up to 20 A and external solid or split sensing ring for three-phase loads up to 150 A.
    b. Current Sensor Range: As required by application.
    c. Current Set Point: Fixed or adjustable as required by application.
    d. Current Sensor Output:
        1) Solid-state, single-pole double-throw contact rated for 30-V ac and dc and for 0.4 A.
        2) Solid-state, single-pole double-throw contact rated for 120-V ac and 1.0 A.
        3) Analog, zero- to 5- or 10-V dc.
        4) Analog, 4 to 20 mA, loop powered.

4. Relay: Single-pole double-throw, continuous-duty coil; rated for 10-million mechanical cycles.
5. Enclosure: NEMA 250, Type 1 enclosure.

2.6 ELECTRICAL POWER DEVICES

A. Transformers:
1. Transformer shall be sized for the total connected load, plus an additional 25 percent of connected load.
2. Transformer shall have both primary and secondary fuses.

B. DC Power Supply:
1. Plug-in style suitable for mating with a standard eight-pin octal socket. Include the power supply with a mating mounting socket.
2. Enclose circuitry in a housing.
3. Include both line and load regulation to ensure a stable output. To protect both the power supply and the load, power supply shall have an automatic current limiting circuit.
4. Performance:
   a. Output voltage nominally 25-V dc within 5 percent.
   b. Output current up to 100 mA.
   c. Input voltage nominally 120-V ac, 60 Hz.
   d. Load regulation within 0.5 percent from zero- to 100-mA load.
   e. Line regulation within 0.5 percent at a 100-mA load for a 10 percent line change.
   f. Stability within 0.1 percent of rated volts for 24 hours after a 20-minute warmup.

2.7 CONTROL WIRE AND CABLE

A. Wire: Single conductor control wiring above 24 V.
1. Conductor shall be 7/24 soft annealed copper strand with 2- to 2.5-inch (50- to 65-mm) lay.
2. Conductor insulation shall be 600 V, Type THWN or Type THHN, and 90 deg C according to UL 83.
3. Conductor colors shall be black (hot), white (neutral), and green (ground).
4. Furnish wire on spools.

B. Single Twisted Shielded Instrumentation Cable above 24 V:
1. Conductors shall be a twisted, 7/24 soft annealed copper strand with a 2- to 2.5-inch (50- to 65-mm) lay.
2. Conductor insulation shall have a Type THHN/THWN or Type TFN rating.
3. Shielding shall be 100 percent type, 0.35/0.5-mil aluminum/Mylar tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
4. Outer jacket insulation shall have a 600-V, 90-deg C rating and shall be Type TC cable.
5. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
6. Furnish wire on spools.

C. Single Twisted Shielded Instrumentation Cable 24 V and Less:
   1. Wire size shall be a minimum No. 20 AWG.
   2. Conductors shall be a twisted, 7/24 soft annealed copper stranding with a 2- to 2.5-inch (50- to 65-mm) lay.
   3. Conductor insulation shall have a nominal 15-mil thickness, constructed from flame-retardant PVC.
   4. Shielding shall be 100 percent type, 1.35-mil aluminum/polymer tape, helically applied with 25 percent overlap, and aluminum side in with tinned copper drain wire.
   5. Outer jacket insulation shall have a 300-V, 105-deg C rating and shall be Type PLTC cable.
   6. For twisted pair, conductor colors shall be black and white. For twisted triad, conductor colors shall be black, red and white.
   7. Furnish wire on spools.

D. LAN and Communication Cable: Comply with DDC system manufacturer requirements for network being installed.
   1. Cable shall be balanced twisted pair.
      a. Cable shall have a unique color that is different from other cables used on Project.

2.8 RACEWAYS

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes.

B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for raceways for balanced twisted pair cables and optical fiber cables.

2.9 IDENTIFICATION

A. Control Equipment, Instruments, and Control Devices:
   1. Self-adhesive label bearing unique identification.
      a. Include instruments with unique identification identified by equipment being controlled or monitored, followed by point identification.
   2. Letter size shall be as follows:
      a. DDC Controllers: Minimum of 0.5 inch high.
      b. Repeaters: Minimum of 0.5 inch high.
      c. Enclosures: Minimum of 0.5 inch high.
      d. Electrical Power Devices: Minimum of 0.25 inch high.
      e. Accessories: Minimum of 0.25 inch high.
      f. Instruments: Minimum of 0.25 inch high.
      g. Control Damper and Valve Actuators: Minimum of 0.25 inch high.
   3. Legend shall consist of white lettering on black background.
   4. Laminated acrylic or melamine plastic sign shall be engraved phenolic consisting of three layers of rigid laminate. Top and bottom layers are color-coded black with contrasting white center exposed by engraving through outer layer and shall be fastened with drive pins.

5. Instruments, control devices and actuators with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require additional identification.

B. Valve Tags:
1. Brass tags and brass chains attached to valve.
2. Tags shall be at least 1.5 inches in diameter.
3. Include tag with unique valve identification indicating control influence such as flow, level, pressure, or temperature; followed by location of valve, and followed by three-digit sequential number. For example: TV-1.001.
4. Valves with Project-specific identification tags having unique identification numbers following requirements indicated and provided by original manufacturer do not require an additional tag.

C. Raceway and Boxes:
1. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
2. Paint cover plates on junction boxes and conduit same color as the tape banding for conduits. After painting, label cover plate "HVAC Controls," using an engraved phenolic tag.
3. For raceways housing pneumatic tubing, add a phenolic tag labeled "HVAC Instrument Air Tubing."
4. For raceways housing air signal tubing, add a phenolic tag labeled "HVAC Air Signal Tubing."

D. Equipment Warning Labels:
1. Self-adhesive label with pressure-sensitive adhesive back and peel-off protective jacket.
2. Lettering size shall be at least 14-point type with white lettering on red background.
3. Warning label shall read "CAUTION-Equipment operated under remote automatic control and may start or stop at any time without warning. Switch electric power disconnecting means to OFF position before servicing."
4. Lettering shall be enclosed in a white line border. Edge of label shall extend at least 0.25 inch beyond white border.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. Verify compatibility with and suitability of substrates.

B. Examine roughing-in for products to verify actual locations of connections before installation.
1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

2. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install products to satisfy more stringent of all requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.

D. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

E. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."

F. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."

G. Fastening Hardware:
1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.

H. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

3.3 ELECTRIC POWER CONNECTIONS

A. Connect electrical power to DDC system products requiring electrical power connections.

B. Design of electrical power to products not indicated with electric power is delegated to DDC system provider and installing trade. Work shall comply with NFPA 70 and other requirements indicated.

C. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers" for electrical power circuit breakers.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power conductors and cables.

E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for electrical power raceways and boxes.

3.4 CONTROL WIRE, CABLE AND RACEWAYS INSTALLATION

A. Comply with NECA 1.

B. Wire and Cable Installation:
   1. Install cables with protective sheathing that is waterproof and capable of withstanding continuous temperatures of 90 deg C with no measurable effect on physical and electrical properties of cable.
      a. Provide shielding to prevent interference and distortion from adjacent cables and equipment.
   2. Terminate wiring in a junction box.
      a. Clamp cable over jacket in junction box.
      b. Individual conductors in the stripped section of the cable shall be slack between the clamping point and terminal block.
   3. Terminate field wiring and cable not directly connected to instruments and control devices having integral wiring terminals using terminal blocks.
   4. Install signal transmission components according to IEEE C2, REA Form 511a, NFPA 70, and as indicated.
   5. Use shielded cable to transmitters.
   6. Use shielded cable to temperature sensors.
   7. Perform continuity and meager testing on wire and cable after installation.

C. Conduit Installation:
   1. Comply with Section "260533 "Raceways and Boxes for Electrical Systems" for control-voltage conductors.
   2. Comply with Section 270528 "Pathways for Communications Systems" for balanced twisted pair cabling and optical fiber installation.

3.5 DDC SYSTEM I/O CHECKOUT PROCEDURES

A. Check installed products before continuity tests, leak tests and calibration.

B. Check instruments for proper location and accessibility.

C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.

D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material and support.

E. Control Damper Checkout:
1. Verify that control dampers are installed correctly for flow direction.
2. Verify that proper blade alignment, either parallel or opposed, has been provided.
3. Verify that damper frame attachment is properly secured and sealed.
4. Verify that damper actuator and linkage attachment is secure.
5. Verify that actuator wiring is complete, enclosed and connected to correct power source.
6. Verify that damper blade travel is unobstructed.

F. Control Valve Checkout:
1. Verify that control valves are installed correctly for flow direction.
2. Verify that valve body attachment is properly secured and sealed.
3. Verify that valve actuator and linkage attachment is secure.
4. Verify that actuator wiring is complete, enclosed and connected to correct power source.
5. Verify that valve ball, disc or plug travel is unobstructed.
6. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

G. Instrument Checkout:
1. Verify that instrument is correctly installed for location, orientation, direction and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments:
   a. Verify sensing element type and proper material.
   b. Verify length and insertion.

3.6 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION AND TESTING:

A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

C. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.

D. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.

E. Provide diagnostic and test equipment for calibration and adjustment.

F. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. An installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.

G. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.

H. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.

I. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.

J. Analog Signals:
   1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
   2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
   3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.

K. Digital Signals:
   1. Check digital signals using a jumper wire.
   2. Check digital signals using an ohmmeter to test for contact making or breaking.

L. Control Dampers:
   1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
   2. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed and 100 percent open.
   3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
   4. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

M. Control Valves:

1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
2. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed and 100 percent open.
3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
4. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

N. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

O. Switches: Calibrate switches to make or break contact at set points indicated.

P. Transmitters:
1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

3.7 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by DDC system manufacturer's authorized service representative. Include quarterly and annual preventive maintenance, repair or replacement of worn or defective components, cleaning, calibration and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative with complete knowledge of Project-specific system installed to train Owner's maintenance personnel to adjust, operate, and maintain DDC system.

END OF SECTION 23 09 23

SECTION 23 09 23.11 - CONTROL VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes control valves and actuators for DDC systems.

B. Related Requirements:
   1. Section 230923 "Direct Digital Control (DDC) System for HVAC" control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

1.3 DEFINITIONS

A. Cv: Design valve coefficient.

B. DDC: Direct-digital control.

C. NBR: Nitrile butadiene rubber.

D. PTFE: Polytetrafluoroethylene

E. RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   3. Product description with complete technical data, performance curves, and product specification sheets.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For control valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

C. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

D. Backup Power Source: Systems and equipment served by a backup power source shall have associated control valve actuators served from a backup power source.

E. Environmental Conditions:
1. Provide electric control valve actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Electric control valve actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.
    a. Hazardous Locations: Explosion-proof rating for condition.

F. Determine control valve sizes and flow coefficients by ISA 75.01.01.

G. Control valve characteristics and rangeability shall comply with ISA 75.11.01.

H. Selection Criteria:
1. Control valves shall be suitable for operation at following conditions:
    a. Heating Hot Water: 200 degrees.
2. Control valve shutoff classifications shall be FCI 70-2, Class IV or better unless otherwise indicated.
3. Valve pattern, three-way or straight through, shall be as indicated on Drawings.
4. Modulating straight-through pattern control valves shall have equal percentage flow-throttling characteristics unless otherwise indicated.
5. Modulating three-way pattern water valves shall have linear flow-throttling characteristics. The total flow through the valve shall remain constant regardless of the valve's position.
6. Modulating butterfly valves shall have equal percentage flow-throttling characteristics.
7. Fail positions unless otherwise indicated:
    a. Heating Hot Water: Open.

8. Globe-type control valves shall pass the design flow required with not more than 95 percent of stem lift unless otherwise indicated.
9. Rotary-type control valves, such as ball and butterfly valves, shall have Cv falling between 65 and 75 degrees of valve full open position and minimum valve Cv between 15 and 25 percent of open position.
10. Selection shall consider viscosity, flashing, and cavitation corrections.
11. Valves shall have stable operation throughout full range of operation, from design to minimum Cv.
12. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.
13. In water systems, select modulating control valves at terminal equipment for a design Cv based on a pressure drop as indicated on the drawings.
14. Modulating valve sizes for steam service shall provide a pressure drop at design flow equal to lesser of the following:
    a. 50 percent of the valve inlet pressure.
    b. 50 percent of the absolute steam pressure at the valve inlet.
15. Two-position control valves shall be line size unless otherwise indicated.
16. In water systems, use ball- or globe-style control valves for two-position control for valves NPS 2 and smaller and butterfly style for valves larger than NPS 2.

2.2 BALL-STYLE CONTROL VALVES

A. Ball Valves with Full Ball and Characterized V-Notch:
1. Performance:
    a. Process Temperature Rating: Minus 20 to plus 500 deg F.
    b. ASME B16.34, Class 600 for NPS 2 and smaller; Class 150 for larger than NPS 2.
    c. Leakage: FCI 70-2, Class VI, bi-directional.
    d. Rangeability: Varies from 200 to 1 up to 800 to 1 based on notch pattern of ball.
    e. Rotation: Zero to 90 degrees.
    f. Equal percentage flow characteristic.
    g. Full port.
2. Face-to-Face Dimension: ASME B16.10 long pattern.
3. Valves NPS 2 and Smaller: ASME B1.20.1 threaded (NPT) ends and three-piece body.
4. Valves NPS 2-1/2 through NPS 12: Flanged ends suitable for mating to ASME B16.5 flanges and two-piece body.
5. Hole in the stem slot of each ball equalizes pressure between the body cavity and the line media flow.
6. Replaceable seat, ball, and shaft packing.
7. Body: Carbon or stainless steel.
8. Ball and Shaft: Stainless steel.
9. Ball Seat: RPTFE.
10. Stem Seals for Valves NPS 2 and Smaller: Live-loaded, self-adjusting, primary and secondary sealing using belleville washers.
    a. Primary Seal: Combination of thrust washer and thrust washer protector.
    b. Secondary Seal: Adjustable stem packing composed of RPTFE V-rings.

11. Stem Seals for Valves Larger than NPS 2: Independent packing gland, adjusted without removing mounting hardware or operator, and contoured to uniformly distribute load across packing.
    a. Primary Seal: Combination of thrust washer and thrust washer protector.
    b. Secondary Seal: Adjustable stem packing composed of RPTFE V-rings.
12. Label each valve with following:
    a. Manufacturer's name, model number, and serial number.
    b. Body size.
    c. Flow directional arrow.

2.3 BUTTERFLY-STYLE CONTROL VALVES

A. Commercial-Grade, Two-Way Butterfly Valves:

1. Performance:
    a. Bi-directional bubble tight shutoff at 250 psig.
    b. Comply with MSS SP-67 or MSS SP-68.
    c. Rotation: Zero to 90 degrees.
    d. Linear or modified equal percentage flow characteristic.
2. Body: Cast iron ASTM A126, Class B, ductile iron ASTM A536 or cast steel ASTM A216/A216M WCB fully lugged, suitable for mating to ASME B16.5 flanges.
3. Disc: 316 stainless steel.
4. Shaft: 316 or 17-4 PH stainless steel.
5. Seat: Reinforced EPDM or reinforced PTFE with retaining ring.
6. Shaft Bushings: Reinforced PTFE or stainless steel.
7. Replaceable seat, disc, and shaft bushings.
8. Corrosion-resistant nameplate indicating:
    a. Manufacturer's name, model number, and serial number.
    b. Body size.
    c. Body and trim materials.
    d. Flow arrow.

2.4 ELECTRIC AND ELECTRONIC CONTROL VALVE ACTUATORS

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. Belimo.
2. Schneider Electric.
3. Griswold Controls.
4. Or equal as approved by the Professional.

B. Actuators for Hydronic Control Valves: Capable of closing valve against system pump shutoff head.

C. Position indicator and graduated scale on each actuator.

D. Type: Motor operated, with or without gears, electric and electronic.

E. Voltage: As indicated on drawings.

F. Deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.

G. Function properly within a range of 85 to 120 percent of nameplate voltage.

H. Construction:
   1. For Actuators Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
   2. For Actuators from 100 to 400 W: Gears ground steel, oil immersed, shaft hardened steel running in bronze, copper alloy or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel or cast-aluminum housing.
   3. For Actuators Larger Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

I. Field Adjustment:
   1. Spring Return Actuators: Easily switchable from fail open to fail closed in the field without replacement.
   2. Gear Type Actuators: External manual adjustment mechanism to allow manual positioning when the actuator is not powered.

J. Two-Position Actuators: Single direction, spring return or reversing type.

K. Modulating Actuators:
   1. Operation: Capable of stopping at all points across full range, and starting in either direction from any point in range.
   2. Control Input Signal:
      a. Three Point, Tristate, or Floating Point: Clockwise and counter-clockwise inputs. One input drives actuator to open position and other input drives actuator to close position. No signal of either input remains in last position.
      b. Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for zero- to 10-V dc and 4- to 20-mA signals.
      c. Pulse Width Modulation (PWM): Actuator drives to a specified position according to pulse duration (length) of signal from a dry contact closure, triac sink, or source controller.
      d. Programmable Multi-Function:
         1) Control Input, Position Feedback, and Running Time: Factory or field programmable.
         2) Diagnostic: Feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
         3) Service Data: Include, at a minimum, number of hours powered and number of hours in motion.

L. Position Feedback:
1. Equip two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.
2. Equip modulating actuators with a position feedback through current or voltage signal for remote monitoring.
3. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

M. Fail-Safe:
1. Where indicated, provide actuator to fail to an end position.
2. Internal spring return mechanism to drive controlled device to an end position (open or close) on loss of power.
3. Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.

N. Integral Overload Protection:
1. Provide against overload throughout the entire operating range in both directions.
2. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

O. Valve Attachment:
1. Unless otherwise required for valve interface, provide an actuator designed to be directly coupled to valve shaft without the need for connecting linkages.
2. Attach actuator to valve drive shaft in a way that ensures maximum transfer of power and torque without slippage.
3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.

P. Temperature and Humidity:
1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.
2. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.

Q. Enclosure:
1. Suitable for ambient conditions encountered by application.
2. NEMA 250, Type 2 for indoor and protected applications.
3. NEMA 250, Type 4 or Type 4X for outdoor and unprotected applications.
4. Provide actuator enclosure with heater and control where required by application.

R. Stroke Time:
1. Operate valve from fully closed to fully open within 60 seconds.
2. Operate valve from fully open to fully closed within 60 seconds.
3. Move valve to failed position within 30 seconds.
4. Select operating speed to be compatible with equipment and system operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for valves installed in piping to verify actual locations of piping connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROL VALVE APPLICATIONS

A. Control Valves:
   1. Select from valves specified in "Control Valves" Article to achieve performance requirements and characteristics indicated while subjected to full range of system operation encountered.
   2. Heating Hot Water System, Two-Way Open-Close Applications Controlled by Temperature: Butterfly-style valves, commercial-grade, two-way valves.
   3. Heating Hot Water System, Two-Way Modulating Applications Controlled by Flow: Ball valves with full ball and characterized V-notch.

3.3 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Install products level, plumb, parallel, and perpendicular with building construction.

C. Properly support instruments, tubing, piping, wiring, and conduits to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment.

D. Fastening Hardware:
   1. Stillson wrenches, pliers, and other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
   2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
   3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

E. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

F. Corrosive Environments:
   1. Use products that are suitable for environment to which they will be subjected.
   2. If possible, avoid or limit use of materials in corrosive environments, including. but not limited to, the following:
      a. Laboratory exhaust airstreams.
      b. Process exhaust airstreams.
   3. Use Type 316 stainless-steel tubing and fittings when in contact with a corrosive environment.
   4. When conduit is in contact with a corrosive environment, use Type 316 stainless-steel conduit and fittings or conduit and fittings that are coated with a corrosive-resistant coating that is suitable for environment.
   5. Where control devices are located in a corrosive environment and are not corrosive resistant from manufacturer, field install products in a NEMA 250, Type 4X enclosure constructed of Type 316L stainless steel.

3.4 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install circuit breakers. Comply with requirements in Section 262816 "Enclosed Switches and Circuit Breakers."

C. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

D. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.5 CONTROL VALVES

A. Install pipe reducers for valves smaller than line size. Position reducers as close to valve as possible but at distance to avoid interference and impact to performance. Install with manufacturer-recommended clearance.

B. Install flanges or unions to allow drop-in and -out valve installation.

C. Install pressure temperature taps in piping upstream and downstream of each control valve larger than NPS 1.

D. Valve Orientation:
   1. Where possible, install globe and ball valves installed in horizontal piping with stems upright and not more than 15 degrees off of vertical, not inverted.
   2. Install valves in a position to allow full stem movement.
   3. Where possible, install butterfly valves that are installed in horizontal piping with stems in horizontal position and with low point of disc opening with direction of flow.

E. Clearance:
   1. Locate valves for easy access and provide separate support of valves that cannot be handled by service personnel without hoisting mechanism.
   2. Install valves with at least 12 inches of clear space around valve and between valves and adjacent surfaces.

F. Threaded Valves:
   1. Note internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
   2. Align threads at point of assembly.
   3. Apply thread compound to external pipe threads, except where dry seal threading is specified.
   4. Assemble joint, wrench tight. Apply wrench on valve end as pipe is being threaded.

G. Flanged Valves:
   1. Align flange surfaces parallel.
   2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.6 CONNECTIONS

A. Connect electrical devices and components to electrical grounding system. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with valve identification on valve.

3.8 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

B. Wash and shine glazing.

C. Polish glossy surfaces to a clean shine.

3.9 CHECKOUT PROCEDURES

A. Control Valve Checkout:
   1. Check installed products before continuity tests, leak tests, and calibration.
   2. Check valves for proper location and accessibility.
   3. Check valves for proper installation for direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
   4. Verify that control valves are installed correctly for flow direction.
   5. Verify that valve body attachment is properly secured and sealed.
   6. Verify that valve actuator and linkage attachment are secure.
   7. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
   8. Verify that valve ball, disc, and plug travel are unobstructed.
   9. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

3.10 ADJUSTMENT, CALIBRATION, AND TESTING

A. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressures.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

D. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION 23 09 23.11

SECTION 23 09 23.12 - CONTROL DAMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following types of control dampers and actuators for DDC systems:
   1. Rectangular control dampers.
   2. General control-damper actuator requirements.
   3. Electric and electronic actuators.

B. Related Requirements:
   1. Section 230923 "Direct-Digital Control System for HVAC" for control equipment and software, relays, electrical power devices, uninterruptible power supply units, wire, and cable.

1.3 DEFINITIONS

A. DDC: Direct-digital control.

B. RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   3. Product description with complete technical data, performance curves, and product specification sheets.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For control dampers to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

C. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

D. Backup Power Source: Systems and equipment served by a backup power source shall have associated control damper actuators served from a backup power source.

E. Environmental Conditions:
1. Provide electric control-damper actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Electric control-damper actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.

F. Selection Criteria:
1. Dampers shall have stable operation throughout full range of operation, from design to minimum airflow over varying pressures and temperatures encountered.
2. Two-position dampers shall be full size of duct or equipment connection unless otherwise indicated.

2.2 RECTANGULAR CONTROL DAMPERS

A. General Requirements:
1. Unless otherwise indicated, use parallel blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed blade configuration.
2. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.
3. Damper actuator shall be factory installed by damper manufacturer as integral part of damper assembly. Coordinate actuator location and mounting requirements with damper manufacturer.

B. Rectangular Dampers with Aluminum Airfoil Blades:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Ruskin.
   b. Greenheck.
   c. Price.
   d. Or equal as approved by the Professional.
2. Performance:
   a. Leakage: AMCA 511, Class 1A. Leakage shall not exceed 3 cfm/sq. ft. against 1-in. wg differential static pressure.
   b. Pressure Drop: 0.05-in. wg at 1500 fpm across a 24-by-24-inch damper when tested according to AMCA 500-D, figure 5.3.
   c. Velocity: Up to 6000 fpm.
   d. Temperature: Minus 40 to plus 185 deg F.
   e. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
   f. Damper shall have AMCA seal for both air leakage and air performance.
3. Construction:
   a. Frame:
      1) Material: ASTM B211, Alloy 6063 T5 extruded-aluminum profiles, 0.07 inch thick.
      2) Hat-shaped channel with integral flange(s). Mating face shall be a minimum of 1 inch.
      3) Width not less than 5 inches.
   b. Blades:
      1) Hollow, airfoil, extruded aluminum.
      2) Parallel or opposed blade configuration as required by application.
      3) Material: ASTM B211, Alloy 6063 T5 aluminum, 0.07 inch thick.
      4) Width not to exceed 6 inches.
      5) Length as required by close-off pressure, not to exceed 48 inches.
   c. Seals:
      1) Blades: Replaceable, mechanically attached extruded silicone, vinyl, or plastic composite.
      2) Jambs: Stainless steel, compression type.
   d. Axles: 0.5-inch-diameter plated steel, mechanically attached to blades.
   e. Bearings:
      1) Molded synthetic or stainless-steel sleeve mounted in frame.
      2) Where blade axles are installed in vertical position, provide thrust bearings.
   f. Linkage:
      1) Concealed in frame.
      2) Constructed of aluminum and plated steel.
      3) Hardware: Stainless steel.
   g. Transition:
      1) For round and flat oval duct applications, provide damper assembly with integral transitions to mate to adjoining field connection.

2) Factory mount damper in a sleeve with a close transition to mate to field connection.
3) Damper size and sleeve shall be connection size plus 2 inches.
4) Sleeve length shall be not less than 12 inches for dampers without jackshafts and shall be not less than 16 inches for dampers with jackshafts.
5) Sleeve material shall match adjacent duct.

h. Additional Corrosion Protection for Corrosive Environments:
1) Provide anodized finish for aluminum surfaces in contact with airstream. Anodized finish shall be a minimum of 0.0007 inch thick.
2) Axles, damper linkage, and hardware shall be constructed of Type 316L stainless steel.

2.3 GENERAL CONTROL-DAMPER ACTUATORS REQUIREMENTS

A. Actuators shall operate related damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which the damper is subjected.

B. Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the fan shutoff pressure as a minimum requirement.

C. The total damper area operated by an actuator shall not exceed 80 percent of manufacturer's maximum area rating.

D. Provide one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison.

E. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.

F. Use jackshafts and shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.

G. Provide mounting hardware and linkages for connecting actuator to damper.

H. Select actuators to fail in desired position in the event of a power failure.

I. Actuator Fail Positions: As indicated on drawings.

2.4 ELECTRIC AND ELECTRONIC ACTUATORS

A. Type: Motor operated, with or without gears, electric and electronic.

B. Voltage:
1. See Drawings.

2. Actuator shall deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.
3. Actuator shall function properly within a range of 85 to 120 percent of nameplate voltage.

C. Construction:
1. Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
2. 100 up to 400 W: Gears ground steel, oil immersed, shaft-hardened steel running in bronze, copper alloy, or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel, or cast-aluminum housing.
3. Greater Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

D. Field Adjustment:
1. Spring return actuators shall be easily switchable from fail open to fail closed in the field without replacement.
2. Provide gear-type actuators with an external manual adjustment mechanism to allow manual positioning of the damper when the actuator is not powered.

E. Two-Position Actuators: Single direction, spring return or reversing type.

F. Position Feedback:
1. Equip two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.
2. Equip modulating actuators with a position feedback through current or voltage signal for remote monitoring.
3. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

G. Fail-Safe:
1. Where indicated, provide actuator to fail to an end position.
2. Internal spring return mechanism to drive controlled device to an end position (open or close) on loss of power.
3. Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.

H. Integral Overload Protection:
1. Provide against overload throughout the entire operating range in both directions.
2. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

I. Damper Attachment:
1. Unless otherwise required for damper interface, provide actuator designed to be directly coupled to damper shaft without need for connecting linkages.
2. Attach actuator to damper drive shaft in a way that ensures maximum transfer of power and torque without slippage.

3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.

J. Temperature and Humidity:
1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.
2. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, non-condensing.

K. Enclosure:
1. Suitable for ambient conditions encountered by application.
2. NEMA 250, Type 2 for indoor and protected applications.
3. NEMA 250, Type 4 or Type 4X for outdoor and unprotected applications.
4. Provide actuator enclosure with a heater and controller where required by application.

L. Stroke Time:
1. Operate damper from fully closed to fully open within 60 seconds.
2. Operate damper from fully open to fully closed within 60 seconds.
3. Move damper to failed position within 30 seconds.
4. Select operating speed to be compatible with equipment and system operation.
5. Actuators operating in smoke control systems comply with governing code and NFPA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for dampers and instruments installed in duct systems to verify actual locations of connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROL-DAMPER APPLICATIONS

A. Control Dampers:

B. Select from damper types indicated in "Control Dampers" Article to achieve performance requirements and characteristics indicated while subjected to full range of system operation encountered.

3.3 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Properly support dampers and actuators, tubing, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment.

C. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

D. Seal penetrations made in fire-rated and acoustically rated assemblies.

E. Fastening Hardware:
   1. Stillson wrenches, pliers, or other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
   2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
   3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

F. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.4 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.5 CONTROL DAMPERS

A. Install smooth transitions, not exceeding 30 degrees, to dampers smaller than adjacent duct. Install transitions as close to damper as possible but at distance to avoid interference and impact to performance. Consult manufacturer for recommended clearance.

B. Clearance:
   1. Locate dampers for easy access and provide separate support of dampers that cannot be handled by service personnel without hoisting mechanism.

2. Install dampers with at least 24 inches of clear space on sides of dampers requiring service access.

C. Service Access:
1. Dampers and actuators shall be accessible for visual inspection and service.
2. Install access door(s) in duct or equipment located upstream of damper to allow service personnel to hand clean any portion of damper, linkage, and actuator. Comply with requirements in Section 233300 "Air Duct Accessories."

D. Install dampers straight and true, level in all planes, and square in all dimensions. Install supplementary structural steel reinforcement for large multiple-section dampers if factory support alone cannot handle loading.

E. Attach actuator(s) to damper drive shaft.

F. For duct-mounted and equipment-mounted dampers installed outside of equipment, install a visible and accessible indication of damper position from outside.

3.6 CONNECTIONS

A. Connect electrical devices and components to electrical grounding system. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with damper identification on damper.

3.8 CHECKOUT PROCEDURES

A. Control-Damper Checkout:
1. Check installed products before continuity tests, leak tests, and calibration.
2. Check dampers for proper location and accessibility.
3. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.
4. Verify that control dampers are installed correctly for flow direction.
5. Verify that proper blade alignment, either parallel or opposed, has been provided.
6. Verify that damper frame attachment is properly secured and sealed.
7. Verify that damper actuator and linkage attachment are secure.
8. Verify that actuator wiring is complete, enclosed, and connected to correct power source.

9. Verify that damper blade travel is unobstructed.

3.9 ADJUSTMENT, CALIBRATION, AND TESTING:

A. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressure.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

D. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION 23 09 23.12

SECTION 23 09 25 - INSTRUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Position limit switches.
   2. Liquid pressure sensors, switches and transmitters.
   3. Air temperature sensors, switches and transmitters.
   4. Liquid temperature sensors, switches and transmitters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   3. Product description with complete technical data, performance curves, and product specification sheets.
   4. Installation operation and maintenance instructions, including factors affecting performance.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Instrumentation to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR FLOW INSTRUMENTS

A. Sensors and transmitters shall have an extended range of 20 percent above Project design flow and 20 percent below minimum Project flow to signal abnormal flow conditions and to provide flexibility for changes in operation.

2.2 LIQUID-PRESSURE SWITCHES

A. Liquid Gage Pressure Switch, Diaphragm Operated, Low Pressure:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Mercoid Controls: Dwyer Instruments, Inc.
      b. Or approved equal.
   2. Description:
      a. Diaphragm operated to actuate an SPDT snap switch.
      b. Electrical Connections: Screw terminal.
      c. Enclosure Conduit Connection: Knock out or threaded connection.
      d. User Interface: External screw with visual set-point adjustment.
      e. Process Connection: Threaded, NPS 1/4.
      f. Enclosure:
         1) Dry Indoor Installations: NEMA 250, Type 1.
         2) Outdoor and Wet Indoor Installations: NEMA 250, Type 4.
         3) Hazardous Environments: Explosion proof.
   3. Operating Data:
      a. Electrical Rating: 15 A at 120-V ac.
      b. Pressure Limits:
         1) Range 1 to 30 psig: 60 psig.
         2) Range 10 to 125 psig: 160 psig.
      c. Temperature Limits: Minus 30 to 150 deg F.
      d. Operating Range: 10 to 250 psig.
      e. Deadband: Fixed.
   4. Pressure Chamber Material: Stainless steel.

B. Liquid-Pressure Differential Switch with Set-Point Indicator:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dwyer Instruments, Inc.
      b. Or approved equal.
   2. Description:
      a. Brass or Type 316 stainless steel double opposing bellows operate to actuate a SPDT snap switch.

b. Electrical Connections: Screw terminal.
c. Enclosure Conduit Connection: Knock out or threaded connection.
d. User Interface: Thumbscrew set-point adjustment with enclosed set-point indicator and scale.
e. High and Low Process Connections: Threaded, NPS 1/8.
f. Enclosure:
    1) Dry Indoor Installations: NEMA 250, Type 1.
    2) Outdoor and Wet Indoor Installations: NEMA 250, Type 4.
    3) Hazardous Environments: Explosion proof.
g. Operating Data:
    1) Electrical Rating: 15 A at 120- to 240-V ac.
    2) Pressure Limits: At least 5 times full-scale range, but not less than system design pressure rating.
    3) Temperature Limits: Minus 10 to 180 deg F.
    4) Operating Range: Approximately 2 times set point.
    5) Deadband: Adjustable or fixed as required by application.

2.3 LIQUID-PRESSURE TRANSMITTERS

A. Liquid-Pressure Differential Transmitter:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dwyer Instruments, Inc.
    b. Or approved equal.
2. Performance:
    a. Range: Approximately 2 times set point.
    b. Span: Adjustable plus or minus one milliamp, noninteractive.
    c. Accuracy: Within 0.25 percent of full scale.
    d. Pressure: Maximum operating pressure 2.5 times range.
    e. Temperature Limits: Zero to 175 deg F.
    f. Compensate Temperature Limits: 30 to 150 deg F.
    g. Thermal Effects: 0.02 percent of full scale per degree F.
    h. Response Time: 30 to 50 ms.
    i. Shock and vibration shall not harm the transmitter.
3. Analog Output Current Signal:
    a. Two-wire, 4- to 20-mA dc current source.
    b. Signal capable of operating into 1000-ohm load.
4. Operator Interface:
    a. Zero and span adjustments located behind cover.
    b. Bleed screws on side of body, two screws on low-pressure side, and one screw on high-pressure side, for air in line and pressure cavity.
5. Construction:
    a. Aluminum and stainless-steel enclosure with removable cover.
    b. Wetted parts of transmitter constructed of 17-4 PH or 300 Series stainless steel.
    c. Threaded, NPS 1/4 process connections on side of instrument enclosure.

d. Knock out for 1/2-inch nominal conduit connection on side of instrument enclosure.
e. Screw terminal block for wire connections.
f. NEMA 250, Type 4X.
g. Mounting Bracket: Appropriate for installation.

6. Three-valve manifold. Construct manifold of brass, bronze, or stainless steel. Manifold shall have threaded, NPS 1/4 process connections.

2.4 AIR TEMPERATURE SENSORS

A. Thermal Resistors (Thermistors): Common Requirements:
1. 10,000 ohms at 25 deg C and a temperature coefficient of 23.5 ohms/ohm/deg C.
2. Two-wire, PTFE-insulated, 22-gage stranded copper leads.
3. Performance Characteristics:
a. Range: Minus 50 to 275 deg F.
b. Interchangeable Accuracy: At 77 deg F within 0.5 deg F.
c. Repeatability: Within 0.5 deg F.
d. Drift: Within 0.5 deg F over 10 years.
e. Self-Heating: Negligible.
4. Transmitter optional, contingent on compliance with end-to-end control accuracy.

B. Space Air Temperature Sensors for Use with DDC Controllers Controlling Terminal Units:
1. Platinum RTD or thermistor.
2. Thermistor:
a. Pre-aged, burned in, and coated with glass; inserted in a metal sleeve; and entire unit encased in epoxy.
b. Thermistor drift shall be less than plus or minus 0.5 deg F over 10 years.
3. Temperature Transmitter Requirements:
a. Mating transmitter required with each 100-ohm RTD.
b. Mating transmitters optional for 1000-ohm RTD and thermistor, contingent on compliance with end-to-end control accuracy.
4. Provide digital display of sensed temperature.
5. Provide sensor with local control.
a. Local override to turn HVAC on.
b. Local adjustment of temperature set point.
c. Both features shall be capable of manual override through control system operator.

2.5 AIR TEMPERATURE RTD TRANSMITTERS

A. Source Limitations: Obtain temperature-measuring sensors and transmitters and airflow from single manufacturer.

B. House electronics in NEMA 250 enclosure.

C. Conduit Connection: 1/2-inch

D. Functional Characteristics:
1. Match sensor with temperature transmitter and factory calibrate together.

2.6 LIQUID TEMPERATURE TRANSMITTERS, COMMERCIAL GRADE

A. House electronics in NEMA 250, Type 4 or Type 4X enclosure.

B. Enclosure Connection: 1/2-inch trade size.

C. Functional Characteristics:
1. Input: 100-ohm platinum RTD temperature coefficient of 0.00385 ohm/ohm/deg C, two- or three-wire sensors.
2. Default Span (Adjustable):
   a. Chilled Water: Zero to 100 deg F.
   b. Condenser Water: Zero to 120 deg F.
   c. Heating Hot Water: 32 to 212 deg F.
3. Output: 4- to 20-mA dc, linear with temperature; RFI insensitive; minimum drive load of 600 ohms at 24-V dc.
4. Zero and span field adjustments, plus or minus 5 percent of span. Minimum span of 50 deg F.
5. Match sensor with temperature transmitter and factory calibrate together. Each matched sensor and transmitter set shall include factory calibration data traceable to NIST.

D. Performance Characteristics:
1. Calibration Accuracy: Within 0.1 percent of the span.
2. Stability: Within 0.2 percent of the span for at least 6 months.
3. Combined Accuracy: Within 0.5 percent.

E. Thermowells:
1. Stem: Straight or stepped shank formed from solid bar stock.
2. Material: Brass or stainless steel.
3. Process Connection: Threaded, NPS 3/4.
4. Sensor Connection: Threaded, NPS 1/2.
5. Bore: Sized to accommodate sensor with tight tolerance between sensor and well.
6. Furnish thermowells installed in insulated pipes and equipment with an extended neck.
7. Length: 4, 6, or 8 inchesas required by application.
8. Thermowells furnished with heat-transfer compound to eliminate air gap between wall of sensor and thermowell and to reduce time constant.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.

C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

D. Prepare written report listing conditions detrimental to performance.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPERATURE INSTRUMENT APPLICATIONS

A. Air Temperature Sensors:
1. Outdoor, Thermistor.
2. Space: Thermistor.

B. Liquid Temperature Sensors:

C. Liquid and Temperature Transmitters:
1. Liquid temperature transmitter, commercial grade.

3.3 INSTALLATION, GENERAL

A. Install products level, plumb, parallel, and perpendicular with building construction.

B. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to force.

C. Fastening Hardware:
1. Stillson wrenches, pliers, and other tools that cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

D. Install products in locations that are accessible and that permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.4 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

B. Furnish and install power wiring. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Furnish and install raceways. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems."

3.5 POSITION INSTRUMENTS INSTALLATION

A. Mounting Location:
   1. Rough-in instrument-mounting locations before setting instruments and routing, cable, wiring, and conduit to final location.
   2. Use manufacturer mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated, using neoprene gaskets or grommets.

3.6 PRESSURE INSTRUMENT INSTALLATION

A. Mounting Location:
   1. Rough-in: Outline instrument-mounting locations before setting instruments and routing, cable, wiring, tubing, and conduit to final location.
   2. Install switches and transmitters for air and liquid pressure associated with individual air-handling units and associated connected ductwork and piping near air-handlings units co-located in air-handling unit system control panel, to provide service personnel a single and convenient location for inspection and service.
   3. Install liquid pressure switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
   4. Install air-pressure switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
   5. Mount switches and transmitters not required to be mounted within system control panels on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

6. Install instruments (except pressure gages) in liquid and liquid-sealed piped services below their process connection point. Slope tubing down to instrument.
7. Install instruments in dry gas and noncondensable vapor piped services above their process connection point. Slope process connection lines up to instrument.

B. Liquid-Pressure Differential Switches:
1. Where process connections are located in mechanical equipment room, install switch in convenient and accessible location near system control panel.
2. Where process connections are installed outside mechanical rooms, route processing tubing to mechanical room housing system control panel and locate switch near system control panel.
3. Where multiple switches serving same system are installed in same room, install switches by system to provide service personnel a single and convenient location for inspection and service.
4. System process tubing connection shall be full size of switch connection, but not less than NPS 1/2. Install bushing if required to mate switch to system connection.
5. Connect process tubing from point of system connection and extend to switch.
6. Install isolation valves in process tubing as close to system connection as practical.
7. Install dirt leg and drain valve at each switch connection.
8. Do not mount switches on rotating equipment.
9. Install switches in a location free from vibration, heat, moisture, or adverse effects, which could damage the switch and hinder accurate operation.
10. Install switches in an easily accessible location serviceable from floor.

C. Liquid-Pressure Transmitters:
1. Where process connections are installed in mechanical equipment room, install transmitter in convenient and accessible location near system control panel.
2. Where process connections are installed outside mechanical rooms, route processing tubing to mechanical room housing system control panel and locate transmitter near system control panel.
3. Where multiple transmitters serving same system are installed in same room, install transmitters by system to provide service personnel a single and convenient location for inspection and service.
4. System process tubing connection shall be full size of switch connection, but not less than NPS 1/2. Install bushing if required to mate switch to system connection.
5. Connect process tubing from point of system connection and extend to transmitter.
6. Install isolation valves in process tubing as close to system connection as practical.
7. Install dirt leg and drain valve at each transmitter connection.
8. Do not mount transmitters on equipment.
9. Install in a location free from vibration, heat, moisture, or adverse effects, which could damage and hinder accurate operation.

3.7 TEMPERATURE INSTRUMENT INSTALLATIONS

A. Mounting Location:
1. Roughing In:

a. Outline instrument mounting locations before setting instruments and routing cable, wiring, tubing, and conduit to final location.
b. Provide inspection to confirm that proposed mounting locations comply with requirements indicated and approved submittals.
c. Complete installation rough-in only after confirmation of inspection is complete.

2. Install switches and transmitters for air and liquid temperature associated with individual air-handling units and associated connected ductwork and piping near air-handling units co-located in air-handling unit system control panel to provide service personnel a single and convenient location for inspection and service.
3. Install temperature switches and transmitters for indoor applications in mechanical equipment rooms. Do not locate in user-occupied space unless indicated specifically on Drawings.
4. Mount switches and transmitters on walls, floor-supported freestanding pipe stands, or floor-supported structural support frames. Use manufacturer's mounting brackets to accommodate field mounting. Securely support and brace products to prevent vibration and movement.

B. Seal penetrations to ductwork, plenums, and air-moving equipment to comply with duct static-pressure class and leakage and seal classes indicated using neoprene gaskets or grommets.

C. Space Temperature Sensor Installation:
1. Conceal assembly in an electrical box of sufficient size to house sensor and transmitter, if provided.
2. Install electrical box with a faceplate to match sensor cover if sensor cover does not completely cover electrical box.
3. In finished areas, recess electrical box within wall.
4. In unfinished areas, electrical box may be surface mounted if electrical light switches are surface mounted. Use a cast-aluminum electric box for surface-mounted installations.
5. Align electrical box with other electrical devices such as visual alarms and light switches located in the vicinity to provide a neat and well-thought-out arrangement. Where possible, align in both horizontal and vertical axis.

D. Outdoor Air Temperature Sensor Installation:
1. Mount sensor in a discrete location facing north.
2. Protect installed sensor from solar radiation and other influences that could impact performance.
3. If required to have a transmitter, mount transmitter remote from sensor in an accessible and serviceable location indoors.

3.8 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.9 CLEANING

A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from exposed interior and exterior surfaces.

3.10 CHECK-OUT PROCEDURES

A. Check installed products before continuity tests, leak tests, and calibration.

B. Check temperature instruments for proper location and accessibility.

C. Verify sensing element type and proper material.

D. Verify location and length.

E. Verify that wiring is correct and secure.

F. Flow Instrument Checkout:
   1. Verify that sensors are installed correctly with respect to flow direction.
   2. Verify that sensor attachment is properly secured and sealed.
   3. Verify that processing tubing attachment is secure and isolation valves have been provided.
   4. Inspect instrument tag against approved submittal.
   5. Verify that recommended upstream and downstream distances have been maintained.

3.11 ADJUSTMENT, CALIBRATION, AND TESTING

A. Description:
   1. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

B. Analog Signals:
   1. Check analog signals using a precision meter at zero, 50, and 100 percent.

C. Digital Signals:
   1. Check digital signals using a jumper wire.
   2. Check digital signals using an ohmmeter to test for contact.

D. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.

E. Switches: Calibrate switches to make or break contact at set points indicated.

F. Transmitters:
   1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
   2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistance source.

3.12 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Perform according to manufacturer's written instruction.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Instrumentation will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.13 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain temperature instruments.

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SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pipes, tubes, and fittings.
   2. Piping specialties.
   3. Piping and tubing joining materials.
   4. Valves.
   5. Pressure regulators.

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, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
   1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:
   1. Piping specialties.
   2. Corrugated, stainless-steel tubing with associated components.

3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
   a. Coordinate pressure regulators selection with suppliers of equipment served.
5. Dielectric fittings.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
   1. Notify Owner no fewer than two weeks in advance of proposed interruption of natural-gas service.
   2. Do not proceed with interruption of natural-gas service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
   5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
   6. Mechanical Couplings:
      a. Steel flanges and tube with epoxy finish.
      b. Buna-nitrile seals.
      c. Stainless-steel bolts, washers, and nuts.
      d. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
   1. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
   2. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1) Flame-Spread Index: 25 or less.
   2) Smoke-Developed Index: 50 or less.

3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
4. Striker Plates: Steel, designed to protect tubing from penetrations.
5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
6. Operating-Pressure Rating: 5 psig.

C. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
   b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
   c. Aboveground Portion: PE transition fitting.
   d. Outlet shall be threaded or flanged or suitable for welded connection.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
4. Transition Service-Line Risers: Factory fabricated and leak tested.
   a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
   b. Outlet shall be threaded or flanged or suitable for welded connection.
   c. Bridging sleeve over mechanical coupling.
   d. Factory-connected anode.
   e. Tracer wire connection.
   f. Ultraviolet shield.
   g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
5. Plastic Mechanical Couplings,NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
   a. PE body with molded-in, stainless-steel support ring.
   b. Buna-nitrile seals.
   c. Acetal collets.
   d. Electro-zinc-plated steel stiffener.
6. Plastic Mechanical Couplings,NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Fiber-reinforced plastic body.
b. PE body tube.
c. Buna-nitrile seals.
d. Acetal collets.
e. Stainless-steel bolts, nuts, and washers.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Corrugated stainless-steel tubing with polymer coating.
4. Operating-Pressure Rating: 0.5 psig.
5. End Fittings: Zinc-coated steel.
6. Threaded Ends: Comply with ASME B1.20.1.
7. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
5. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Bronze Plug Valves: MSS SP-78.
1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig.
6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. PE Ball Valves: Comply with ASME B16.40.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Kerotest Manufacturing Corp.
    b. Lyall, R. W. & Company, Inc.
    c. Perfection Corporation.

2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

2.5 PRESSURE REGULATORS

A. General Requirements:
1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Coordinate selections of pressure regulator with suppliers of equipment served.

C. Line Pressure Regulators: Comply with ANSI Z21.80.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. American Meter Company.
b. Fisher Control Valves & Instruments; a brand of Emerson Process Management.
c. Invensys.
d. Maxitrol Company.
2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Description:
a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Description:
a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
1. Description:
a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 30 below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.
   1. If natural-gas piping is installed less than 30 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:
   1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
   3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

F. Install pressure gage downstream from each service regulator.

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, and above ceilings unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
   1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
   2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
   3. In Floor Trenches: Install natural-gas piping in floor trenches. Trench must have cover and be open to space above cover for ventilation.
   4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:
   a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each regulator.

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
   1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
   2. Cut threads full and clean using sharp dies.
   3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
   4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
   5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
   1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
   2. Bevel plain ends of steel pipe.
   3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End Pipe and Fittings: Use butt fusion.
   2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
   2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
   3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
   4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
   5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
   1. Alkyd System: MPI EXT 5.1D.
      a. Prime Coat: Alkyd anticorrosive metal primer.
      b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
      c. Topcoat: Exterior alkyd enamel (semigloss).
      d. Color: Safety yellow.

B. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
   1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
      a. Prime Coat: Alkyd metal primer.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Interior latex (semigloss).
      d. Color: Safety yellow.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be the following:

1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.

B. Aboveground natural-gas piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:
1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Annealed-temper, copper tube with wrought-copper fittings and brazed joints.
3. Aluminum tube with flared fittings and joints.
4. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:
1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.

B. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Cast-iron, nonlubricated plug valve.

C. Valves in branch piping for single appliance shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

END OF SECTION 23 11 23

SECTION 23 21 13 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:
   1. Hot-water heating piping.
   2. Chilled-water piping.
   3. Condensate-drain piping (air conditioning condensate).

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
   1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
   1. Hot-Water Heating Piping: 150 psig at 200 deg F.
   2. Chilled-Water Piping: 150 psig at 200 deg F.

3. Condensate-Drain Piping: 150 deg F.
4. Air-Vent Piping: 200 deg F.
5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. Wrought-Copper Unions: ASME B16.22.

2.3 PLASTIC PIPE AND FITTINGS

A. CPVC Plastic Pipe: ASTM F 441/F 441M, with wall thickness as indicated in "Piping Applications" Article.
1. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.

B. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.
1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Solvent Cements for Joining Plastic Piping:
1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
a. PVC solvent cement shall have a VOC content of 510 g/L or less.
b. Adhesive primer shall have a VOC content of 550 g/L or less.

c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 TRANSITION FITTINGS

A. Plastic-to-Metal Transition Fittings:
1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

B. Plastic-to-Metal Transition Unions:
1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Description:
a. Standard: ASSE 1079.
b. Pressure Rating: 150 psig.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
1. Description:
a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 150 psig.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:
1. Description:
a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:
1. Description:
a. Standard: IAPMO PS 66.
b. Electroplated steel nipple, complying with ASTM F 1545.
c. Pressure Rating: 300 psig at 225 deg F.
d. End Connections: Male threaded or grooved.
e. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe, wrought-steel fittings and forged-steel flanges, and welded and flanged joints.

C. Condensate-Drain Piping: Type M or Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

D. Air-Vent Piping:
1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

E. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install valves according to Section 230523 "Valves for HVAC Piping."

Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

S. Install shutoff valve immediately upstream of each dielectric fitting.

T. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits or nipples.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers for individual horizontal piping 20 feet or longer.
   3. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 7 feet.
   2. NPS 1: Maximum span, 7 feet.
   3. NPS 1-1/2: Maximum span, 9 feet.
   4. NPS 2: Maximum span, 10 feet.
   5. NPS 2-1/2: Maximum span, 11 feet.
   6. NPS 3 and Larger: Maximum span, 12 feet.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. NPS 1-1/4Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
   1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
   2. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
   3. PVC Nonpressure Piping: Join according to ASTM D 2855.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

D. Install ports for pressure gages and thermometers at coil inlet and outlet connections.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:
   1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:
1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

SECTION 23 21 16 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes special-duty valves and specialties for the following:
   1. Hot-water heating piping.
   2. Chilled-water piping.
   3. Condensate-drain piping (air conditioning condensate).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following:
   1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
   2. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
   1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
   1. Hot-Water Heating Piping: 150 psig at 200 deg F.
   2. Chilled-Water Piping: 150 psig at 200 deg F.
   3. Condensate-Drain Piping: 150 deg F.

2.2 VALVES

A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "Valves for HVAC Piping."

B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230924 "Control Valves and Dampers."

C. Bronze, Calibrated-Orifice, Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett; a Xylem brand.
      c. Flow Design, Inc.
      d. Griswold Controls.
      e. Nexus Valve, Inc.
      f. NuTech Hydronic Specialty Products.
      g. Taco.
   2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
   3. Ball: Brass or stainless steel.
   4. Plug: Resin.
   5. Seat: PTFE.
   6. End Connections: Threaded or socket.
   7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
   8. Handle Style: Lever, with memory stop to retain set position.
   9. CWP Rating: Minimum 125 psig .
   10. Maximum Operating Temperature: 250 deg F .

D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armstrong Pumps, Inc.
      b. Bell & Gossett; a Xylem brand.

c. Flow Design, Inc.
d. Gerand Engineering Co.
e. Griswold Controls.
f. Nexus Valve, Inc.
g. NuTech Hydronic Specialty Products.
h. Taco.

2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
3. Ball: Brass or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Disc: Glass and carbon-filled PTFE.
6. Seat: PTFE.
7. End Connections: Flanged or grooved.
8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
9. Handle Style: Lever, with memory stop to retain set position.
10. CWP Rating: Minimum 125 psig .
11. Maximum Operating Temperature: 250 deg F .

2.3 AIR-CONTROL DEVICES

A. Manual Air Vents:
1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 .
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig .
7. Maximum Operating Temperature: 225 deg F .

B. Automatic Air Vents:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. AMTROL, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett; a Xylem brand.
d. Nexus Valve, Inc.
e. NuTech Hydronic Specialty Products.
f. Taco, Inc.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4 .
7. CWP Rating: 150 psig .
8. Maximum Operating Temperature: 240 deg F .

C. Bladder-Type Expansion Tanks:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. AMTROL, Inc.
b. Armstrong Pumps, Inc.
c. Bell & Gossett; a Xylem brand.
d. Taco, Inc.
2. Tank: Welded steel, rated for 125-psig working pressure and 375 deg F) maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

2.4 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:
1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 40-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:
1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

C. Spherical, Rubber, Flexible Connectors:
1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install throttling-duty valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

D. Install check valves at each pump discharge and elsewhere as required to control flow direction.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

END OF SECTION 23 21 16

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Refrigerant pipes and fittings.
   2. Refrigerant piping, valves and specialties for variable refrigerant flow systems.
   3. Refrigerants.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping 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 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Brazing Filler Metals: AWS A5.8/A5.8M.

E. Flexible Connectors:
1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.2 VALVES AND SPECIALTIES

A. Variable Refrigerant Flow Systems: Branch fittings, distribution header kits, equipment connection kits and valves as furnished by the equipment manufacturer.

B. Service Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Danfoss Inc.
   b. Emerson Climate Technologies.
   c. Heldon Products; Henry Technologies.
   d. Parker Hannifin Corp.
   e. Paul Mueller Company.
   f. Refrigeration Sales, Inc.
2. Body: Forged brass with brass cap including key end to remove core.
3. Core: Removable ball-type check valve with stainless-steel spring.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Copper spring.
6. Working Pressure Rating: 500 psig.

C. Angle-Type Strainers:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Danfoss Inc.
b. Heldon Products; Henry Technologies.
c. Parker Hannifin Corp.

2. Body: Forged brass or cast bronze.
3. Drain Plug: Brass hex plug.
4. Screen: 100-mesh monel.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT PIPING

A. NPS 1-1/2 and Smaller: Copper, Type ACR annealed-temper tubing and wrought-copper fittings with brazed joints.

B. NPS 1-1/2 and Smaller: Copper, Type ACR drawn-temper tubing and wrought-copper fittings with brazed joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves for gage taps and strainer at inlet and service valves for gauge taps at outlet of hot-gas bypass valves if they are not an integral part of the valve.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Maintain refrigerant piping clean and dry during installation.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. 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.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping adjacent to machines to allow service and maintenance.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Select system components with pressure rating equal to or greater than system operating pressure.

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 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, 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. Insulate suction ,liquid and discharge gas piping and tubing in accordance with Section 230719 “HVAC Piping Insulation”

S. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing, to prevent scale formation.

D. 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.

3.5 HANGERS AND SUPPORTS

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
   2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.
   5. 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 diameters:
   1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
   2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
   3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
   4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
   5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
   6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
   7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
   8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
   9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

D. Support multifloor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Comply with ASME B31.5, Chapter VI.
   2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
   3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "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.

B. Prepare test and inspection reports.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:
1. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers, following testing. If vacuum holds for 12 hours, system is ready for charging.
2. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
3. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning 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 23 23 00

SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Leakage tests

1.3 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
   3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-

support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Ductmate Industries, Inc.
      b. Lindab Inc.
      c. McGill AirFlow LLC.
      d. MKT Metal Manufacturing, Inc.
      e. SEMCO LLC.
      f. Sheet Metal Connectors, Inc.
      g. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
   2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved,

duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. CertainTeed Corporation.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.
   2. Maximum Thermal Conductivity:
      1) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature. Flexible elastomeric duct liner in first paragraph below is not suitable for temperatures higher than 220 deg F (104 deg C).
   3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

a. Adhesive shall have a VOC content of 80 g/L or less.
b. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm or higher.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
a. Fan discharges.
b. Intervals of lined duct preceding unlined duct.
c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal

flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Static Pressure Class 4-Inch wg and higher: Seal Class A.
   3. Static Pressure Class 3-Inch wg: Seal Class B.
   4. Static Pressure Class 2-Inch wg and lower: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.
   2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
      a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:
   1. Ducts Connected to Constant-Volume Air-Handling Units:
      a. Pressure Class: Positive 3-inch wg.

C. Return Ducts:
   1. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive or negative 3-inch wg.

D. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting General Purpose and Toilet Room Air:
      a. Pressure Class: Negative 2-inch wg.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
   1. Ducts Connected to Air-Handling Units:
      a. Pressure Class: Positive or negative 2-inch wg.

F. Intermediate Reinforcement:
   1. Galvanized-Steel Ducts: Galvanized steel.
   2. Aluminum Ducts: Aluminum.

G. Liner:
   1. Supply Air Ducts: Fibrous glass, Type II, 1-1/2 inches thick.
   2. Return Air Ducts: Fibrous glass, Type II 1-1/2 inches thick.
   3. Transfer Ducts: Fibrous glass, Type II, 1 inch thick.

H. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
         2) Mitered Type RE 4 without vanes.
      b. Velocity 1000 to 1500 fpm:
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
      c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
   a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
      3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
      4) Radius-to Diameter Ratio: 1.5.
   b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
   c. Round Elbows, 14 Inches and Larger in Diameter: [Standing seam] [Welded].

I. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Spin in.
   2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
      a. Velocity 1000 fpm or Lower: 90-degree tap.
      b. Velocity 1000 to 1500 fpm: Conical tap.
      c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

C. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

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. American Warming and Ventilating; a Mestek Architectural Group company.
   2. Cesco Products; a divsion of MESTEK, Inc.
   3. Greenheck Fan Corporation.
   4. Lloyd Industries, Inc.
   5. Nailor Industries Inc.
   6. Pottorff.
   7. Ruskin Company.
   8. Vent Products Co., Inc.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 2000 fpm.

D. Maximum System Pressure: 3-inch wg.

E. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, center pivoted, maximum 6-inch width, with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Neoprene, mechanically locked.

I. Blade Axles:
1. Material: Stainless steel.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Galvanized steel.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball.

M. Accessories:
1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
   a. Sleeve Thickness: 20 gage minimum.
   b. Sleeve Length: 6 inches minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Galvanized steel.
8. Screen Type: Bird.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames:
   a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
   b. Mitered and welded corners.
   c. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Galvanized-steel, 0.064 inch thick.
5. Blade Axles: Galvanized steel.
6. Bearings:
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:
1. Standard leakage rating, with linkage outside airstream.
2. Suitable for horizontal or vertical applications.
3. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
   a. Multiple or single blade.
   b. Parallel- or opposed-blade design.
   c. Stiffen damper blades for stability.
   d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
   e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
5. Blade Axles: Stainless steel.
6. Bearings:
   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
7. Tie Bars and Brackets: Aluminum.

2.5 CONTROL DAMPERS

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. American Warming and Ventilating; a Mestek Architectural Group company.
2. Arrow United Industries.
3. Cesco Products; a divsion of MESTEK, Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Metal Form Manufacturing, Inc.
7. Nailor Industries Inc.
8. Pottorff.
9. Ruskin Company.
10. Vent Products Co., Inc.
11. Young Regulator Company.

B. Low-leakage rating, with linkage inside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
1. Hat shaped.
2. 0.094-inch-thick, galvanized sheet steel.
3. Mitered and welded corners.

D. Blades:
1. Multiple blade with maximum blade width of 6 inches.

2. Parallel- and opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin or 0.0747-inch-thick dual skin.
5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch-diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:
1. Molded synthetic or stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

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. American Warming and Ventilating; a Mestek Architectural Group company.
2. Arrow United Industries.
3. Cesco Products; a divsion of MESTEK, Inc.
4. Greenheck Fan Corporation.
5. Nailor Industries Inc.
6. Pottorff.
7. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, 0.024-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Resettable and replaceable, 165 deg F rated, fusible links.

2.7 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
   1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Double wall.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Number of Hinges and Locks:
      a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
      b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
      c. Access Doors up to 24 by 48 Inches: Continuous hinge and two compression latches with outside handles.
      d. Access Doors Larger Than 24 by 48 Inches: Continuous hinge and two compression latches with outside and inside handles.

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

C. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers in exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.
   2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire dampers according to UL listing.

H. Connect ducts to duct silencers rigidly.

I. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coils.
   2. Upstream from duct filters.
   3. At outdoor-air intakes and mixed-air plenums.
   4. At drain pans and seals.
   5. Downstream from control dampers, backdraft dampers, and equipment.
   6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   7. At each change in direction and at maximum 50-foot spacing.
   8. Control devices requiring inspection.
   9. Elsewhere as indicated.

J. Install access doors with swing against duct static pressure.

K. Access Door Sizes:
1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

L. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

M. Install flexible connectors to connect ducts to equipment.

N. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

O. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

P. Connect diffusers to ducts directly or with maximum 72-inch lengths of flexible duct clamped or strapped in place.

Q. Connect flexible ducts to metal ducts with draw bands.

R. Install duct test holes where required for testing and balancing purposes.

S. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 23 33 00

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Centrifugal roof ventilators.
   2. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.8 QUALITY ASSURANCE

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

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Greenheck Fan Corporation.
2. Hartzell Fan Incorporated.
3. JencoFan.
4. Loren Cook Company.
5. PennBarry.

2.2 CENTRIFUGAL ROOF VENTILATORS

A. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
   3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
   4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
   5. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
   1. Configuration: Built-in raised cant and mounting flange.
   2. Overall Height: 12 inches.
   3. Pitch Mounting: Manufacture curb for roof slope.
   4. Metal Liner: Galvanized steel.

2.3 IN-LINE CENTRIFUGAL FANS

A. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

B. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

C. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

D. Accessories:
   1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
   2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
   3. Companion Flanges: For inlet and outlet duct connections.
   4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
   5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.4 PROPELLER FANS

A. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.

B. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.

C. Fan Wheel: Replaceable, extruded-aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.

D. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Fan Drive:
1. Resiliently mounted to housing.
2. Statically and dynamically balanced.
3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
4. Extend grease fitting to accessible location outside of unit.
5. Service Factor Based on Fan Motor Size: 1.4.
6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   a. Ball-Bearing Rating Life: ABMA 9, L_{10} of 100,000 hours.
8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

F. Accessories:
1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Weathershield Hood: Galvanized steel to match fan and accessory size.
5. Weathershield Front Guard: Galvanized steel with expanded metal screen.
6. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
7. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Min not imum size as indicated. If indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:
1. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC."

C. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

D. Support suspended units from structure using threaded steel rods and spring hangers having a static deflection of 1 inch. Vibration-control devices are specified in Section 230548 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 23 34 23

SECTION 23 37 13 – DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Diffusers, registers and grilles for air handling systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Schedule: Indicate drawing designation, room location, quantity, model number, size, air flow and accessories furnished.

B. Color Samples: For architect's review and approval.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Carnes Company.
   2. Hart & Cooley Inc.
   3. METALAIRE, Inc.
   4. Nailor Industries Inc.
   5. Price Industries.
   6. Titus.
   7. Tuttle & Bailey.

2.2 RECTANGULAR AND SQUARE CEILING DIFFUSERS

A. Devices shall be specifically designed for variable-air-volume flows.

B. Material: Steel.

C. Finish: Baked enamel, white.

D. Face Size: 24 by 24 inches.

E. Face Style: Four cone.

F. Mounting: As scheduled.

G. Pattern: Fixed.

H. Dampers: Combination damper and grid.

I. Accessories:
1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.

2.3 REGISTERS

A. Adjustable Blade Face Register:
1. Material: Steel.
2. Finish: Baked enamel, white.
3. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
4. Core Construction: Integral.
5. Rear-Blade Arrangement: Vertical spaced 1/2 inch apart.
6. Frame: 1-1/4 inches wide.
7. Mounting: Lay in.
8. Damper Type: Adjustable opposed blade.
9. Accessories:
   a. Rear-blade gang operator.
   b. Filter.

2.4 GRILLES

A. Fixed Face Grille.
1. Material: Steel.
2. Finish: Baked enamel, white.
3. Face Blade Arrangement: Horizontal; spaced 1/2 inch apart.
4. Face Arrangement: Perforated core.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Lay in.

2.5 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts (except locations with plenum returns) and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13.13

SECTION 23 37 13.43 - SECURITY REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes security registers and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples for Initial Selection: For registers and grilles with factory-applied color finishes.

C. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Carnes Company.
   2. Hart & Cooley Inc.
   3. METALAIRE, Inc.
   4. Nailor Industries Inc.
   5. Price Industries.
   6. Titus.
   7. Tuttle & Bailey.

2.2 SECURITY DIFFUSERS

A. Security diffuser:
1. Security Level: Minimum.
2. Application: Ducted supply.
3. Material: Steel.
4. Material Thickness: 12 gauge.
5. Finish: Baked enamel, white.
6. Face Arrangement:
    a. Shape: Square.
    b. Design: Lattice.
    c. Frame: Yes.
    d. Core: Louvered.
    e. 12 gauge thick, front lattice plate with 13/16” square holes and 3/16” frets.
7. Damper Operation: Face operated.
8. Damper Type: Opposed blade.
9. Mounting: 1 1/2 by 1 1/2 by 3/16-inch retaining angle frame and tamperproof machine screws.

2.3 SECURITY REGISTERS

A. Security Register:
1. Security Level: Minimum.
2. Application: Ducted supply.
3. Material: Steel.
4. Material Thickness: 16 gauge frame, 14 gauge sleeve and louvers.
5. Finish: Baked enamel, white.
6. Face Arrangement:
    a. Shape: Square and Rectangular.
    b. Design: Fixed bar.
    c. Frame: Yes.
    d. Deflection: 38 degrees.
    e. Core: None.
7. Damper Operation: Face operated.
8. Damper Type: Opposed blade.
9. Wall Sleeve: 14 gauge welded to face.
10. Mounting: 1 1/2 by 1 1/2 by 3/16-inch retaining angle frame field welded.

2.4 SUICIDE DETERRENT SECURITY GRILLES

A. Security Grille:
1. Security Level: Maximum with suicide deterrent.
2. Application: Ducted supply.
3. Material: Steel.

4. Material Thickness: 3/16” inch.
5. Finish: Baked enamel, white.
6. Face Arrangement:
    a. Shape: Square and Rectangular.
    b. Design: Perforated.
    c. Deflection: 0 degrees.
    d. Core: None.
7. Wall Sleeve: 3/16 inch.
8. Mounting: 1 1/2 by 1 1/2 by 3/16-inch retaining angle frame field welded.

2.5 SECURITY GRILLES

A. Security Grille:
1. Security Level: Minimum.
2. Application: Ducted and plenum return.
3. Material: Steel.
4. Material Thickness: 16 gauge frame, 14 gauge sleeve and louvers.
5. Finish: Baked enamel, white.
6. Face Arrangement:
    a. Shape: Square and Rectangular.
    b. Design: Fixed bar.
    c. Frame: Yes.
    d. Deflection: 38 degrees.
    e. Core: None.
7. Damper Operation: Face operated.
8. Damper Type: Opposed blade.
9. Wall Sleeve: 14 gauge welded to face.
10. Mounting: 1 1/2 by 1 1/2 by 3/16-inch retaining angle frame field welded.

2.6 SECURITY GRILLES

A. Security Grille:
1. Security Level: Minimum.
2. Application: Exhaust.
3. Material: Aluminum.
4. Material Thickness: 0.09” frame and sleeve, 3/16” louvers.
5. Finish: Baked enamel, white.
6. Face Arrangement:
    a. Shape: Square and Rectangular.
    b. Design: Fixed bar.
    c. Frame: Yes.
    d. Deflection: 0 degrees.
    e. Core: None.
7. Damper Operation: Face operated.
8. Damper Type: Opposed blade.

9. Wall Sleeve: 14 gauge welded to face.
10. Mounting: 1 1/2 by 1 1/2 by 1/8 inch retaining angle frame field welded.

2.7 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts (except locations with return plenums) and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13.43

SECTION 23 51 23 - GAS VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Listed double-wall vents.
2. Flashing materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.1 LISTED SPECIAL GAS VENTS

A. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.

C. Inner Shell: ASTM A959, Type 29-4C stainless steel.

D. Outer Jacket: Stainless steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
1. Termination: Exit cone with drain section incorporated into riser.

2.2 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Listed Type B and BW Vents: Vents for certified gas appliances.

B. Listed Type L Vent: Vents for low-heat appliances.

C. Listed Special Gas Vent: Condensing gas appliances.

3.3 INSTALLATION OF LISTED VENTS

A. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Lap joints in direction of flow.

3.4 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings.

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.5 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 235123

SECTION 23 74 16.11 - PACKAGED, SMALL-CAPACITY, 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components:
   1. Casings.
   2. Fans, drives, and motors.
   3. Rotary heat exchangers.
   4. Coils.
   5. Refrigerant circuit components.
   6. Air filtration.
   7. Dampers.
   8. Electrical power connections.
   9. Controls.
   10. Roof curbs.
   11. Accessories.

1.3 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.4 ACTION SUBMITTALS

A. Product Data: For each RTU.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
   3. Include unit dimensions and weight.
   4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
   5. Fans:

a. Include certified fan-performance curves with system operating conditions indicated.
b. Include certified fan-sound power ratings.
c. Include fan construction and accessories.
d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include gas furnaces with performance characteristics.
9. Include dampers, including housings, linkages, and operators.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranty.

B. Source quality-control reports.

C. System startup reports.

D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.
1. Warranty Period: two year(s) from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than five years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance: Comply with UL 1995.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Carrier Corporation; a unit of United Technologies Corp.
   2. Daikin Applied.
   3. Trane Inc.
   4. YORK; a Johnson Controls company.

2.3 UNIT CASINGS

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. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

C. Condensate Drain Pans:
   1. Construction:
      a. Single-wall, noncorrosive polymer sheet.
   2. Drain Connection:
      a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
      b. Minimum Connection Size: NPS 3/4.

2.4 FANS, DRIVES, AND MOTORS

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.
   1. Shafts: With field-adjustable alignment.
      a. Turned, ground, and polished hot-rolled steel with keyway.

2. Shaft Bearings:
   a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.
3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.
   a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.
4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
6. Shaft Lubrication Lines: Extended to a location outside the casing.

C. Drives, Direct: Factory-mounted, direct drive.

D. Condenser-Coil Fan: propeller, mounted on shaft of permanently lubricated ECM motors.

2.5 COILS

A. General Requirements for Coils:
1. Comply with AHRI 410.
2. Fabricate coils section to allow for removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Supply-Air Refrigerant Coil:
1. Tubes: Copper.
2. Fins:
   a. Material: Aluminum.
3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel.
6. Coatings: None.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
   a. Working Pressure: Minimum 300 psig.

C. Outdoor-Air Refrigerant Coil:
1. Tubes: Copper.
2. Fins:
   a. Material: Aluminum.
3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel.
6. Coatings: None.

7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.
   a. Working Pressure: Minimum 300 psig.

D. Electric-Resistance Heating Coils: Comply with UL 1995.
1. Casing Assembly: Flanged type with galvanized-steel frame.
2. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
3. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from coil section.
4. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
5. Control Panel: Unit mounted with disconnecting means and overcurrent protection.
   a. Magnetic contactor.
   b. Solid-state, stepless pulse controller.
   c. Toggle switches, one per step.
   d. Step controller.
   e. Time-delay relay.
   f. Pilot lights, one per step.
   g. Airflow proving switch.

2.6 AIR FILTRATION

A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."

B. Panel Filters:
1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.

2.7 DAMPERS

A. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed-blade arrangement with steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Retain "Damper Operators" or "Electronic Damper Operators" Paragraph below. Retain first paragraph if damper operators are specified in Section 230923.12 "Control Dampers." Retain second paragraph to require that damper operators be provided by unit manufacturer. Not all manufacturers offer this option; consult manufacturers. If retaining second paragraph, coordinate with Division 23 controls Sections for electrical service to devices.

2.8 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.9 CONTROLS

A. Basic Unit Controls:
   1. Control-voltage transformer.
   2. Wall-mounted thermostat or sensor with the following features:
      a. Heat-cool-off switch.
      b. Fan on-auto switch.
      c. Fan-speed switch.
      d. Manual changeover.
      e. Adjustable deadband.
      f. Unoccupied-period-override push button.
      g. Data entry and access port to input temperature set points, occupied and unoccupied periods, and output room temperature, supply-air temperature, operating mode, and status.
   3. Remote Wall-Mounted Annunciator Panel for Each Unit:
      a. Lights to indicate power on, cooling, heating, fan running, filter dirty, and unit alarm or failure.
      b. DDC controller or programmable timer and interface with HVAC instrumentation and control system.
      c. Digital display of outdoor-air temperature, supply-air temperature, return-air temperature, economizer damper position, indoor-air quality, and control parameters.

2.10 ROOF CURBS

A. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.
   1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.
      a. Materials: ASTM C1071, Type I or II.
      b. Thickness: 1 inch.
   2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.
      a. Liner Adhesive: Comply with ASTM C916, Type I.
      b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.

c. Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
d. Liner Adhesive: Comply with ASTM C916, Type I.

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 or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 3/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

3.4 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. 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.

D. RTU will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Inspect for visible damage to unit casing.
   3. Inspect for visible damage to furnace combustion chamber.
   4. Inspect for visible damage to compressor, coils, and fans.
   5. Inspect internal insulation.
   6. Verify that labels are clearly visible.
   7. Verify that clearances have been provided for servicing.
   8. Verify that controls are connected and operable.
   9. Verify that filters are installed.
   10. Clean condenser coil and inspect for construction debris.
   11. Verify lubrication on fan and motor bearings.
   12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
   13. 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.
   14. Inspect and record performance of interlocks and protective devices; verify sequences.
   15. Operate unit for an initial period as recommended or required by manufacturer.
   16. Calibrate thermostats.
   17. Adjust and inspect high-temperature limits.
   18. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
   19. 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.
   20. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
   21. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.
      a. Supply-air volume.
      b. Return-air volume.
      c. Outdoor-air intake volume.
   22. 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.
   23. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.9 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.10 CLEANING

A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. 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.

F. RTU will be considered defective if it does not pass tests and inspections.

G. Prepare test and inspection reports.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain RTUs.

END OF SECTION 23 74 16.11

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

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

B. ASHRAE Compliance:
   1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
1. Warranty Period:
a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Carrier Corporation; a unit of United Technologies Corp.
2. Daikin Applied.
3. Trane Inc.
4. YORK; a Johnson Controls company.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:
1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.

3. Fan: Direct drive, centrifugal.
4. Fan Motors:
   a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
   c. Enclosure Type: Totally enclosed, fan cooled.
   d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
   e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
   f. Mount unit-mounted disconnect switches on interior of unit.
5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:
   a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
      1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
      2) Depth: A minimum of 1 inch deep.
   b. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
   c. Pan-Top Surface Coating: Asphaltic waterproofing compound.
7. Air Filtration Section:
   a. General Requirements for Air Filtration Section:
      1) Comply with NFPA 90A.
      2) Minimum MERV according to ASHRAE 52.2.
      3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
   b. Disposable Panel Filters:
      1) Factory-fabricated, viscous-coated, flat-panel type.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:
1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
   a. Compressor Type: Scroll.
   b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.

c. Refrigerant: R-454B.
d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:
1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply[and return] ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 26

SECTION 23 82 33 - CONVECTORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes hydronic convectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Color Samples for Initial Selection: For units with factory-applied color finishes.

PART 2 - PRODUCTS

2.1 HOT-WATER CONVECTORS

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. Engineered Air.
   2. Slant/Fin Corp.
   3. Sterling HVAC Products; a Mestek company.
   4. Trane.

B. Heating Elements: Seamless copper tubing mechanically expanded into evenly spaced aluminum fins and rolled into cast-iron or brass headers with inlet/outlet and air vent; steel side plates and supports. Factory-pressure-test element at minimum 100 psig.

C. Front and Top Panel: Minimum 0.0677-inch-thick steel with exposed corners rounded; removable front panels with tamper-resistant fasteners braced and reinforced for stiffness.

D. Wall-Mounted Back and End Panels: Minimum 0.0428-inch-thick steel.

E. Floor-Mounted Pedestals: Conceal conduit for power and control wiring at maximum 36-inch spacing. Pedestal-mounted back panel shall be solid panel matching front panel.

F. Support Brackets: Locate at maximum 36-inch spacing to support front panel and element.

G. Insulation: 1/2-inch-thick, fibrous glass on inside of the back of the enclosure.

H. Finish: Baked-enamel finish in manufacturer's standard color as selected by Architect.

I. Damper: Knob-operated internal damper.

J. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches, integral with enclosure.

K. Enclosure Style: Flat top.
   1. Bottom Inlet: grille, painted to match enclosure.
   2. Front Outlet Grille: Punched louver; painted to match enclosure.
      a. Anodized finish, color as selected by Architect from manufacturer's standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive convectors for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for hydronic-piping connections to verify actual locations before installation of convector.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install convectors level and plumb.

B. Install valves within reach of access door provided in enclosure.

C. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.

3.3 CONNECTIONS

A. Connect hot-water convectors and components to piping according to Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties."
   1. Install shutoff valves on inlet and outlet, and balancing valve on outlet.

B. Install piping adjacent to convectors to allow service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, start convectors to confirm proper operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Convectors will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 23 82 33

SECTION 23 82 39.16 - PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes propeller unit heaters with hot-water coils.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. PTFE: Polytetrafluoroethylene plastic.

C. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Airtherm; a Mestek company.
   2. Daikin Applied.

3. Engineered Air.
4. Modine.
5. Trane.

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

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

C. Comply with UL 2021.

D. Comply with UL 823.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. General Coil Requirements: Test and rate hot-water propeller unit-heater coils according to ASHRAE 33.

B. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

2.7 CONTROLS

A. Control Devices:
1. Unit-mounted thermostat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and elastomeric hangers. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 CONNECTIONS

A. Install piping adjacent to machine to allow service and maintenance.

B. Connect piping to propeller unit heater's factory, hot-water piping package. Install the piping package if shipped loose.

C. Comply with safety requirements in UL 1995.

D. Unless otherwise indicated, install union and ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of propeller unit heater. Hydronic specialties are specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties."

E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

G. Provide unit heaters with power disconnect switch.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   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. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION 23 82 39.16

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. “Provide” shall mean furnish and install the referenced item complete with all its appurtenances, devices, options, features, and supports to assure a complete and working installation in accordance with all applicable codes and standards.

1.3 DESCRIPTION OF WORK

A. Provide complete and operable electrical and auxiliary systems as follows in accordance with the intent of this Specification and accompanying Drawings:
   1. Provide power system study.
   2. Provide electrical distribution equipment as designated on the contract drawings.
   3. Provide whole building back-up power with dedicated life safety normal/emergency distribution and service rated automatic transfer switch.
   4. Provide electrical power requirements including branch circuit conduit & wiring, safety switches, & associated electrical equipment to serve mechanical equipment scheduled to be provided for new sallyport addition.
   5. Provide new interior and exterior lighting as designated on the contract drawings.
   6. Emergency lighting and path of egress lighting shall be served from new life safety distribution from new dual 400kW gas generators. Relocate existing emergency lighting circuits to new life safety distribution.
   7. Provide and connect new fire alarm system devices compatible with the existing Notifier (by Honeywell) to fire alarm system main control panel for sallyport addition.
   8. Provisions for miscellaneous power requirements throughout building as shown on contract drawings.
   9. Provide new LED luminaires for replacement of existing fluorescent luminaires and re-connect to existing circuits.
   10. Provide New Cat6A data cabling, patch panels, jacks, labeling and testing as shown on drawings.
   11. Replace existing data cabling with Cat6A data cabling and jacks.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division

1 Specification Sections.

B. Coordinate electrical distribution equipment submittals, procurement, and release for manufacture with the preliminary power system study required by Section 260573 “Power System Studies.” Do not release distribution equipment for manufacture until the preliminary short-circuit and coordination study information required by Section 260573 has been submitted and reviewed, unless specifically authorized in writing by the Engineer.

C. Record Drawings: Submit As-Built Drawings.

1.5 QUALITY ASSURANCE

A. Installation and components shall comply with the latest edition of the National Electrical Code.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

C. The Terms “Listed and Labeled”: As defined in the National Electrical Code, Article 100.

D. Test Equipment Suitability and Calibration: Comply with NETA ATS, “Suitability of Test Equipment” and Test Instrument Calibration.”

1.6 SEQUENCING AND SCHEDULING

A. Coordinate electrical equipment arrangement, mounting, and support.
   1. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   2. So connecting raceways and cables will be clear of obstructions and of the working and access space of other equipment.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.

C. Coordinate installation of electrical identification after completion of finishing where identification is applied to field-finished surfaces.

D. Coordinate installation of electrical identifying devices and markings prior to installing finishes that conceal such items.

E. Complete the final power system studies required by Section 260573 “Power System Studies” after approval of applicable electrical equipment submittals and prior to final acceptance. Implement study-required protective-device settings, equipment revisions, and field-applied labels prior to energization for final operation and prior to Project closeout.

F. Electrical power outage requirements shall be coordinated with the Owner. Contractor shall inform the Owner ten days prior to removal of electrical power. All power outage work shall be coordinated with the Owner prior to start of work.
   1. Temporary power for critical loads shall be coordinated with the Owner. The Contractor shall be responsible for providing temporary power as required to accommodate critical

loads. Temporary power shall be provided by an alternate source. Utilization of facility power or power outages scheduled to be performed during designated hours (determined by the facility) are acceptable, but only if approved by the Owner.

1.7 PLANS AND SPECIFICATIONS

A. The Plans and Specifications are Contract Bid Documents, and are for the purpose of illustrating the general character and Scope of Work for Contractors to prepare a Bid Proposal.

B. The Contract Plans are diagrammatic and are intended to convey the Scope of Work and general location and arrangement of equipment. The Plans are not Shop Drawings and do not dismiss the Contractor from the responsibility of preparing fabrication and installation Shop Drawings, nor do they relieve the Contractor from the responsibility of coordinating Division 26 Work with the Work of other trades and the building structure.

C. Use fabrication and installation Shop Drawings along with manufacturer's installation instructions to construct the Work of this Contract.

D. In addition to the Work shown on the Drawings and described in Specifications, provide all incidental Work and material required to fulfill the intent of the Plans and Specifications. This shall include all required labor, materials, devices, means, and methods peculiar to the machinery, equipment, apparatus, or systems to be installed.

E. By submitting bid, the Contractor assumes responsibility for any conflicts or misinterpretations of the Contract Documents. It is the sole responsibility of the Contractor to clarify any discrepancies in Contract Documents in writing with the Professional prior to submitting a bid. The Contractor shall not at any time after the execution of his Contract, set up any claims whatsoever based upon insufficient data or incorrect assumptions, nor shall the Contractor claim any misunderstanding with regard to the nature, conditions, or character of the Work to be performed under this Contract. Any equipment purchased incorrectly shall be replaced without additional expense to the Owner.

1.8 SITE VISIT

A. Include in Bid Price: Cost for equipment, materials and labor to accommodate the Work of this Specification.

B. It shall be the responsibility of the Contractor to verify the dimensions and locations of equipment shown on the Drawings in the field. Contractor shall obtain all information necessary for completion of the Work and for items specified before submission of Bids.

C. Before ordering any materials, or performing any Work, the Contractor shall verify all measurements at the building site and shall be responsible for the correctness of same. No extra compensation will be allowed on account of differences between actual dimensions and those indicated on the Drawings. Any difference which may be found shall be submitted to the Professional for consideration before proceeding with the Work. The Contractor shall report all ambiguities or discrepancies to the Professional for written clarification before submitting a Bid.

1.9 WARRANTY

A. Unless longer time periods are indicated, the Contractor shall unconditionally guarantee, in writing, all Work, articles, appliances, materials, equipment, and workmanship furnished, installed, or supplied under this Contract for a period of one year from the date of acceptance by the Owner.

B. The Contractor shall adjust, repair, or replace any defective part of the system without cost to the Owner.

C. All such repairs and/or replacements shall be made without delay and at the convenience of the Owner.

1.10 CODES AND STANDARDS

A. Provide equipment and installation in accordance with this Specification and applicable requirements of the following:
   1. American National Standards Institute (ANSI)
   2. American Society for Testing and Materials (ASTM)
   3. Americans With Disabilities Act (Public Law 101-336)
   4. Institute of Electrical and Electronic Engineers (IEEE)
   5. National Electrical Code (NEC)
   6. Occupational Safety and Health Administration (OSHA)
   7. Underwriters Laboratories Inc. (UL)
   8. National Fire Protection Association: National Fire Codes
   9. International Building Code (IBC)
   10. Pennsylvania Department of Labor and Industry Fire and Panic Regulations
   11. National Electrical Manufacturers' Association (NEMA)
   12. National Electrical Contractors' Association (NECA)
   13. International Cable Engineers' Association (ICEA)
   14. U.S. Department of Health
   15. Pennsylvania Department of Health
   16. All local codes and ordinances

B. The Contractor shall obtain all permits, licenses, and approvals with the departments having jurisdiction, pay all charges and fees, file all necessary plans, and give all notices necessary and incident to do the lawful prosecution of the Work.

C. Contractor shall obtain and furnish to the Owner all certificates for Work for which certificates are required. The Contractor shall pay for all federal, state, county, borough, township, and city fees, permits, licenses, laws, and/or other fees which may be required in the performance of this Contract and not otherwise provided for.

PART 2 - PRODUCTS

2.1 MATERIALS GENERAL

A. All electrical products installed in this project shall be listed by Underwriters Laboratories, Inc., or shall be approved in writing by the local inspection authority as required by governing codes and ordinances.

B. All material shall be new and bear manufacturer's name, model number, electrical characteristics and other identification. All material shall be of the best quality and shall be manufactured in accordance with the applicable standards.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. 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.

3.2 PICK-RESISTANT SECURITY SEALANT

A. Apply pick-resistant security sealant to all new exposed surface mounted rigid galvanized steel conduit installed in existing building.

3.3 FIRESTOPPING

A. Apply fire-stopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

3.4 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal installations for damage and faulty work.

END OF SECTION 26 50 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Fire-alarm wire and cable.
4. Connectors, splices, and terminations rated 600 V and less.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.3 DEFINITIONS

A. RoHS: Restriction of Hazardous Substances.

B. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

D. Conductor Insulation:
1. Type THWN-2: Comply with UL 83.
Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

C. Circuits:
1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors Ground Conductor: Insulated.

E. Conductor Insulation:
1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

F. Armor: Steel interlocked.

2.3 FIRE-ALARM WIRE AND CABLE

A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

B. Signaling Line Circuits: Twisted, shielded pair, not less than, no. 18 AWG and size as recommended by system manufacturer.

1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper.
2. Type: One hole with standard barrels.
3. Termination: Compression

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

D. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW- 2, single conductors in raceway.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in new finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 INSTALLATION OF FIRE-ALARM WIRING

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal pathway according to Section 270528.29 "Hangers and Supports for Communications Systems."
   1. Install plenum cable in environmental airspaces, including plenum ceilings.

2. Fire-alarm circuits and equipment control wiring associated with fire-alarm system shall be installed in a dedicated pathway system. This system shall not be used for any other wire or cable.

C. Wiring Method:
1. Cables and pathways used for fire-alarm circuits, and equipment control wiring associated with fire-alarm system, may not contain any other wire or cable.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with fire-alarm system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire-alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire-alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire-alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent receipt or transmission of signals from other floors or zones.

3.5 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

D. Comply with requirements in Section 283100 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.1 PICK-RESISTANT SECURITY SEALANT

A. Apply pick-resistant security sealant to all new exposed surface mounted rigid galvanized steel conduit, boxes, supports, and fittings installed in existing building where detention and shelter occupants have access.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections with the assistance of a factory-authorized service representative.
   1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
   2. Perform each of the following visual and electrical tests:
      a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
      b. Test bolted connections for high resistance using one of the following:
         1) A low-resistance ohmmeter.
         2) Calibrated torque wrench.
         3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.
d. Inspect for correct identification.
e. Inspect cable jacket and condition.
f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
g. Continuity test on each conductor and cable.
h. Uniform resistance of parallel conductors.

3. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
   a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
4. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

D. Cables will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports to record the following:
1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

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

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Burndy; Part of Hubbell Electrical Systems.
2. Dossert; AFL Telecommunications LLC.
3. ERICO International Corporation.
4. Fushi Copperweld Inc.
5. Galvan Industries, Inc.; Electrical Products Division, LLC.
6. Harger Lightning & Grounding.

7. ILSCO.
8. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
9. Robbins Lightning, Inc.
10. Siemens Power Transmission & Distribution, Inc.
11. Or equal as approved by the Professional.

2.2 CONDUCTORS

A. Insulated Conductors: tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B3.
   2. Stranded Conductors: ASTM B8.
   3. Tinned Conductors: ASTM B33.
   4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
   5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
   6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
   7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.3 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Straps: Solid copper, Rated for 600 A.

I. Water Pipe Clamps:
1. Mechanical type, two pieces with stainless-steel bolts.
a. Material: Die-cast zinc alloy.
2. U-bolt type with malleable-iron clamp and copper ground connector.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad 3/4 inch by 10 feet.

B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors
3. Connections to Ground Rods: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
   1. Feeders and branch circuits.
   2. Lighting circuits.
   3. Receptacle circuits.
   4. Single-phase motor and appliance branch circuits.
   5. Three-phase motor and appliance branch circuits.
   6. Flexible raceway runs.
   7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct- mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.5 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. Use exothermic welds for all below-grade connections.
   3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

   1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
   2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
   3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm(s).
5. Substations and Pad-Mounted Equipment: 5 ohms.

G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Design Professional promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.
1. Include design calculations and details of hangers.

1.3 QUALITY ASSURANCE

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch- diameter holes at a maximum of 8 inches o.c. in at least one surface.
   1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   2. Material for Channel, Fittings, and Accessories: Galvanized steel.
   3. Channel Width: 1-5/8 inches.
   4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
   5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for 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 made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
   4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   5. Toggle Bolts: All-steel springhead type.
   6. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers

and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Electrical equipment shall have seismic supports in accordance with BOCA 96 requirements.

C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for conduit as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with conduit clamps.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 or Spring-tension clamps.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. 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 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Electri-Flex Company.
5. FSR Inc.
6. O-Z/Gedney; an EGS Electrical Group brand; an Emerson Industrial Automation business.
7. Patriot Aluminum Products, LLC.
8. Picoma Industries.
9. Republic Conduit.
10. Robroy Industries.
11. Southwire Company.
12. Thomas & Betts Corporation, A Member of the ABB Group.
13. Western Tube and Conduit Corporation.
14. Wheatland Tube Company.
15. Or equal as approved by the Professional.

B. Metal Conduit:
1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined

in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. EMT: Comply with ANSI C80.3 and UL 797.
4. FMC: Comply with UL 1; zinc-coated steel.
5. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

C. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for EMT:
a. Material: Steel or die cast.
b. Type: Compression. Set screw fittings are not permitted.

D. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carlon Electrical Products
2. Prime Conduit
3. Allied Tube and Conduit.
4. ElectricFlex Company.
5. RACO; Hubbell.
6. Thomas & Betts Corporation, A Member of the ABB Group.
7. Or equal as approved by the Professional.

B. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

C. Nonmetallic Fittings:
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
3. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters,

hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep or 4 inches by 2-1/8 inches by 2-1/8 inches deep.

I. Gangable boxes are allowed.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated.
   1. Exposed Existing Construction, Not Subject to Severe Physical Damage, Detention, or Shelter Occupants: EMT.
   2. Exposed Existing Construction, Subject to Severe Physical Damage, Detention, or Shelter Occupants: GRC w/pick-resistant security sealant along wall and conduit body, fittings, supports.
   3. New Construction Concealed in Ceilings and Interior Walls and Partitions: EMT.

4. Existing Construction Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC, LFMC.
7. Under Slab Conduit: RNC, Type EPC-40-PVC.
8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in damp or wet locations.

B. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: GRC.
3. Underground Conduit: RNC, Type EPC-40-PVC
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type NEMA 3R.

C. Minimum Raceway Size: 3/4-inch trade size.
1. Minimum size underground/ below slab: 1-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. EMT: Use compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not fasten conduits onto the bottom side of a metal deck roof.

D. Keep raceways at least 6 inches away from parallel runs of flues and hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

G. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

H. Conceal conduit within finished walls, ceilings, and floors in new construction unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

I. Surface conduit on existing finished walls in existing construction unless otherwise indicated. Install conduits parallel or perpendicular to building lines. Detention, or Shelter Occupant areas: GRC w/pick-resistant security sealant along wall and conduit body, fittings, supports.

J. Support conduit within 12 inches of enclosures to which attached.

K. Stub-ups to Above Recessed Ceilings:
1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

L. Threaded Conduit Joints, Exposed Interior existing construction, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. EMT fittings shall be compression.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

Q. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations.

R. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.

S. New construction Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a flush connection between the box and cover plate or the supported equipment and box.

T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

U. Locate boxes so that cover or plate will not span different building finishes.

V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

X. Set metal floor boxes level and flush with finished floor surface.

Y. Install device raceways in accordance with manufacturer's requirements.

Z. Install fire rated floor boxes in accordance with manufacturer's requirements and all applicable codes.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

3.5 PICK-RESISTANT SECURITY SEALANT

A. Apply pick-resistant security sealant to all new exposed surface mounted rigid galvanized steel conduit, boxes, fittings, and supports installed in existing building where Detention, or Shelter Occupants have access.

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

B. Related Requirements:
1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

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

F. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
   b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Carbon steel
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. 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 that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
   1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
      b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
   2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
   3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
   4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.

D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
   1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
   2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between

pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Tags.
4. Signs.
5. Cable ties.
6. Fasteners for labels and signs.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E and Section 260573.19 “Arc-Flash Hazard Analysis” requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature

changes.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:
   1. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
   1. Color shall be factory applied.
   2. Colors for 208/120-V Circuits:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   3. Colors for 480/277-V Circuits:
      a. Phase A: Brown
      b. Phase B: Orange
      c. Phase C: Yellow
   4. Color for Neutral: White.
   5. Color for Equipment Grounds: Green.
   6. Colors for Isolated Grounds: Green with white stripe.

C. Equipment Identification Labels:
   1. Black letters on a white field.

2.3 LABELS

A. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

2.4 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:
   1. Engraved legend.
   2. Thickness:
      a. For signs up to 20 sq. in., minimum 1/16 inch thick.
      b. For signs larger than 20 sq. in., 1/8 inch thick.
      c. Engraved legend with black letters on white face.
      d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting or Self-adhesive.
      e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.5 CABLE TIES

A. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
   1. Minimum Width: 3/16 inch.
   2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
   3. UL 94 Flame Rating: 94V-0.
   4. Temperature Range: Minus 50 to plus 284 deg F.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Vinyl Wraparound Labels:
   1. Secure tight to surface at a location with high visibility and accessibility.
   2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive

appropriate to the location and substrate.

K. Self-Adhesive Labels:
1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

L. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

M. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

N. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

P. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

Q. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on minimum 1-1/2-inch- high sign; where two lines of text are required, use signs minimum 2 inches high.

R. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-

foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive wraparound labels with the conductor designation.

E. Equipment Identification Labels:
1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine plastic sign.
3. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Provide labels for all equipment unless equipment is provided with its own identification.
4. Equipment to be Labeled: All equipment shall Identify equipment name, system voltage, and where it is served from (Including panel name and circuit number).
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Transformers.
   e. Lighting Luminaires.
   f. Emergency system boxes and enclosures.
   g. Enclosed switches.
   h. Enclosed motor controllers.
   i. Control Panels.
   j. Fire Alarm Equipment.
5. Receptacle Labeling: All receptacles shall be labeled with Self-adhesive clear labels with 3/32” black lettering on the front coverplate of the receptacle. Receptacle labeling shall identify panel name and circuit number from where it is served. Example “RP6-16”.

END OF SECTION – 26 05 53

SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:
   1. Load-flow and voltage-drop study.
   2. Short-circuit study.
   3. Overcurrent protective device coordination study.
   4. Arc-flash incident energy study.

1.2 ACTION SUBMITTALS

A. Power System Study Reports:

   1. Submit Preliminary Study Report for action prior alongside distribution equipment submittals for Engineer review and approval. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Engineer for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
      a. Preliminary short circuit study data shall be sufficient to ensure that all equipment has satisfactory short circuit current ratings. Minimum deliverables shall include the following:
         1) Utility available fault current data or documented assumptions.
         2) Listing of evaluated modes of operation (i.e. utility, generator).
         3) Single-line diagram with short-circuit currents at each bus for each case.
         4) Worst-case equipment duty table.
      b. If selective coordination or partial coordination is required, preliminary coordination study data shall be sufficient to ensure that protective devices are able to achieve satisfactory coordination. Minimum deliverables shall include the following:
         1) Preliminary Time-current Characteristic (TCC) curves for portions of the system with NFPA 70 partial or full selective coordination requirements.
   2. Submit Final Study Report after approval of protective device submittals.

B. Data files for final studies. All data files shall be fully unlocked.

1.3 QUALITY ASSURANCE

A. Submittals for power system studies must be signed and sealed by qualified electrical professional engineer responsible for their preparation.

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B. Studies must be performed using commercially developed and distributed software designed specifically for power system analysis.

C. Software algorithms must comply with requirements of standards and guides specified in this Section.

D. Manual calculations are unacceptable.

E. Field Adjusting Agency Qualifications: An independent agency, with experience and capability to adjust overcurrent devices and to conduct testing indicated, that is a member company of InterNational Electrical Testing Association (NETA) 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.

F. Power System Study Provider Qualifications: Professional engineer in charge of performing study and documenting recommendations, licensed in state where Project is located. All elements of study shall be performed under direct supervision and control of this professional engineer.

1.4 PRE-QUALIFIED VENDORS

A. The following Power System Study Providers are pre-qualified for this Project:
   1. Entech Engineering, Inc., Reading, PA / Beaver Falls, PA
      a. Nicholas J. Bloom, P.E.
      b. nbloom@entecheng.com
      c. 412-516-2449
   2. Current Solutions, P.C., White Plains, NY
      a. Mark B. Cavallaro, P.E.
      b. mcavallaro@currentsolutionspc.com
      c. 914-347-8480, Ext 11
   3. Redcon Engineering, Inc., Carnegie, PA
      a. Marty Micko, P.E.
      b. mmicko@redconengineering.com
      c. 412-886-5001

B. Other Power System Study Providers must be pre-qualified by submitting a formal request with company resume at least fourteen (14) days prior to the Bid Date. The Q&E package must contain a list of six similar sized previous projects with references and project profiles for projects similar in scope to this Project.

C. Engineer shall review qualifications, experience, project profiles, and references and may add via addendum to the list of qualified Power System Study Provider firms. Bidder may only utilize pre-qualified firms.

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PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE

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. EasyPower; brand of Bentley Systems, Inc.
   2. ETAP; brand of Operation Technology, Inc.; subsidiary of Schneider Electric
   3. Power Tools for Windows (PTW); brand of SKM Systems Analysis, Inc.

B. Standard Features:

   1. Power System Analysis:
      a. Computer software application must be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program must report device settings and ratings of overcurrent protective devices and must demonstrate selective coordination by computer-generated, time-current coordination plots.
      b. Computer software application must be designed to perform arc-flash analysis or have function, component, or add-on module designed to perform arc-flash analysis.
   2. Analysis Standards:
      a. Short-Circuit Current Analysis: In accordance with IEEE 3002.3.
      b. Device Coordination Analysis: In accordance with IEEE 3004.3 and IEEE 3004.5.
      c. Arc-Flash Incident Energy Analysis: In accordance with IEEE 1584-2018.
   3. Capable of printing customized available fault current and arc-flash hazard warnings for equipment on vinyl, weather- and UV-resistant, pressure-sensitive adhesive labels complying with NFPA 70E.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Collect and analyze data for power system studies.
   1. Verify completeness of data supplied in one-line diagram on Drawings. Call discrepancies to Engineer's attention.
   2. For equipment included as Work on the Project, use characteristics submitted under provisions of action submittals and information submittals for the Project.
   3. For relocated equipment and equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers in accordance with NFPA 70E.
   4. Gather and tabulate required input data to support power system studies. Comply with recommendations in IEEE 3002 series standards as to amount of detail that is required to be acquired in field. Field data gathering must be by, or under supervision of, qualified electrical professional engineer. Data include, but are not limited to, the following:

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a. Product data for the Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams and overcurrent protective device submittals.
b. Electrical power utility impedance at service.
c. Power sources and ties.
d. Full-load current of loads.
e. Voltage level at each bus.
f. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, and taps measured in percent.
g. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
h. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip unit and available range of settings, SCCR, current rating, and breaker settings.
i. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
j. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
k. Maximum demands from service meters.
l. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
m. Motor horsepower and NEMA MG 1 code letter designation.
n. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
o. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
p. Derating factors.

3.2 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform load-flow and voltage-drop study to determine steady-state loading profile of system. Analyze power system performance two times as follows:
1. Determine load flow and voltage drop based on full-load currents for connected loads.
2. Determine load flow and voltage drop based on 80 percent of design capacity of load buses.
3. Prepare load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.
a. Acceptance criteria for connected loads:
1) Voltage at all buses shall be at least 0.95 pu.
2) Transformers shall not exceed nameplate ratings.
3) Feeders shall not exceed rated ampacity.

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3.3 SHORT-CIRCUIT STUDY

A. Preparation of Data for Short-Circuit Study:
   1. Verify completeness of data supplied on one-line diagram. Call discrepancies to Engineer's attention.
   2. For equipment included as Work on the Project, use characteristics submitted under provisions of action submittals and information submittals for the Project.
   3. Prepare one-line diagram of modeled power system, showing the following:
      a. Protective device designations and ampere ratings.
      b. Conductor types, sizes, and lengths.
      c. Transformer kVA and voltage ratings.
      d. Motor and generator designations and kVA ratings.
      e. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
      f. Derating factors and environmental conditions.
      g. Revisions to electrical equipment required by study.

B. Base study on device characteristics supplied by device manufacturer.

C. Begin short-circuit current analysis at service, extending down to all system low-voltage load buses with overcurrent protective devices.

D. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

E. Include AC fault-current decay from induction motors and synchronous motors and generators. Also account for fault-current DC decrement to address asymmetrical requirements of interrupting equipment.

F. Short Circuit Study:
   1. Calculate short-circuit momentary and interrupting duties for three-phase bolted fault and single line-to-ground fault at equipment within the scope of the study.

G. Equipment Duty Evaluation:
   1. Compare calculated equipment duty to short-circuit ratings.
   2. Evaluate adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
   3. Application of series-rated devices must be noted and comply with all requirements in NFPA 70. Series ratings are not permitted unless specifically approved in writing.
   4. Include in report identification of any protective device or equipment applied outside its ratings.

3.4 OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

A. Preparation of Data for Overcurrent Protective Device Coordination Study:
   1. Identify devices which require full selective coordination or partial coordination in

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accordance with NFPA 70 requirements and any additional devices to be coordinated as indicated on Drawings. Refer to the edition of NFPA 70 in effect for the project. The following NFPA 70 Articles shall be consulted at minimum:

1) NFPA 70 required partial coordination (faults >0.1 second):
   a) 517 – Health Care Facilities Essential Electrical Systems
2) NFPA 70 required full selective coordination:
   a) 620 – Multiple elevators supplied by a single feeder
   b) 645 – Critical Operations Data Systems
   c) 695 – Fire pumps
   d) 700 – Emergency Systems
   e) 701 – Legally Required Standby Systems
   f) 708 – Critical Operations Power Systems

2. Examine the Project's overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work.
3. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

B. Base study on device characteristics supplied by device manufacturer.

C. Begin analysis at service, extending down to all system low-voltage load buses with overcurrent protective devices.

D. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for the Project. Study cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

E. Prepare Time-Current Characteristic (TCC) curves for devices within the power system necessary to determine if the system provides adequate equipment protection and coordination. Provide recommendations for optimal settings of adjustable overcurrent protective devices to achieve coordination.
1. TCCs shall be provided for all the following portions of the distribution system:
   a. Any device where full selective coordination or partial coordination is required by NFPA 70. Include all upstream devices.
   b. Utility sources, including protective devices.
   c. Generator short-circuit decrement curve and generator damage curve.
   d. Mains, feeders, and significant branch devices greater than 60 A. Include largest outgoing circuit breaker in each switchgear, switchboard, motor-control center, and panelboard.
   e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
   f. Motor-starting characteristics and motor damage points for motors larger than 10 HP.
   g. Ground-fault protective devices.
2. TCC General Requirements:
   a. Prepare separate sets of curves for switching schemes and for emergency periods

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where power source is local generation.

b. Show the following information:
   1) Device tag and title, one-line diagram with legend identifying portion of system covered.
   2) Terminate device characteristic curves at point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
   3) Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

3. Selective Coordination Requirements:
   a. Where full selective coordination is required by NFPA 70, this shall be over the entire range of available fault currents. Manufacturer-specific coordination tables may be referenced to demonstrate full-range coordination and applicable available fault current limits.
   b. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Provide adequate time margins between device characteristics such that selective operation is achieved.
   c. Maintain selectivity for tripping currents caused by overloads.
   d. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices. Series ratings are not permitted unless specifically approved in writing.
4. Equipment Protection Requirements:
   a. Transformer Primary Overcurrent Protective Devices:
      1) Device must not operate in response to the following:
         a) Inrush current when first energized.
         b) Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
         c) Permissible transformer overloads in accordance with IEEE C57.96 if required by unusual loading or emergency conditions.
      2) Device settings must protect transformers in accordance with IEEE C57.12.00, for fault currents.
   b. Motor Protection:
      1) Select protection for low-voltage motors greater than 10 HP in accordance with IEEE 3004.8 and NFPA 70.
      2) Select protection for motors served at voltages more than 600 V in accordance with IEEE 620.
   c. Conductor Protection: Protect cables against damage from fault currents in accordance with ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 3004.7. Demonstrate that equipment withstands maximum short-circuit current for time equivalent to tripping time of primary relay protection or total clearing time of fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
   d. Generator Protection: Select protection in accordance with manufacturer's published instructions and IEEE C37.102.

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3.5 ARC-FLASH INCIDENT ENERGY STUDY

A. Preparation of Data for Arc-Flash Incident Energy Study:
   1. Assemble data from short-circuit study and overcurrent protective device coordination study.
   2. Identify enclosure size, working distance, electrode configuration, and electrode spacing for each device. IEEE-default values for enclosure sizes, working distances, and electrode spacing are acceptable but should be carefully reviewed.
      a. VCBB shall be specified for equipment containing MCCBs or VFDs.
      b. HCB shall be specified for disconnect switches, MCCs, and switchgear.
   3. Review main device inclusion or exclusion at each bus. Document this decision.
   4. Review any special circumstances where a 2-second maximum arcing time is not applicable.
   5. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

B. Comply with NFPA 70E, including Annex D, for arc-flash hazard study.

C. Preparatory Studies: Obtain short-circuit study and overcurrent protective device coordination study results prior to starting arc-flash hazard study.

D. Utilize IEEE 1584-2018 methodology where applicable. Calculation shall be prepared using realistic values of fault current contribution from utility sources and motors. Prepare multiple study cases if significant variations in utility source configuration or motor running status are possible.

E. Calculate arc-flash boundary and incident energy at all locations in electrical distribution system where personnel could perform work on energized parts. This shall include all switchgear, switchboards, panelboards, motor-control centers, motor controllers, industrial control panels, elevator control panels, disconnect switches, enclosed circuit breakers, and similar equipment.

F. Include medium- and low-voltage equipment locations.

G. Incident energy calculations must consider accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations must account for changing current contributions, as sources are interrupted or decremented with time. Fault contribution from motors and generators must be decremented as follows:
   1. Fault contribution from induction motors must not be considered beyond three to five cycles.
   2. Fault contribution from synchronous motors and generators must be decayed to match actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 p.u. to 3 p.u. after 10 cycles).

H. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584-2018, Section 6.9.1, unless not reasonable for specific locations.

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I. A separate scenario shall be prepared to document reduced incident energy results with energy reducing maintenance switches engaged; however, these results shall NOT be printed on the label. Labels shall be generated based on worst-case scenario results.

3.6 POWER SYSTEM STUDY REPORT

A. Preparation of Power System Study Report: Prepare and submit the following:
   1. Load-Flow and Voltage-Drop Study Section Contents:
      a. Executive summary of study findings.
      b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
      c. Comments and recommendations for system improvements, such as addressing overloaded feeders or panels and improving excessive voltage drop.
   2. Short-Circuit Study Section Contents:
      a. Executive summary of study findings.
      b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
      c. Comments and recommendations for system improvements or revisions.
      d. Short-Circuit Study Input Data:
         1) One-line diagram of system being studied.
         2) Power sources available and their electrical characteristics.
         3) Manufacturer, model, and interrupting rating of protective devices.
         4) Protective device designations and ampere ratings.
         5) Conductor types, sizes, and lengths.
         6) Transformer kVA, impedance, and voltage ratings.
         7) Motor and generator designations and kVA ratings.
         8) Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
         9) Derating factors and environmental conditions.
         10) Revisions to electrical equipment required by study.
      e. Protective Device Evaluation:
         1) Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
      f. Short-Circuit Study Output Reports:
         1) Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
            a) Voltage.
            b) Symmetrical fault-current magnitude.
            c) X/R ratio.
            d) Asymmetrical fault RMS current.
            e) Asymmetrical fault peak current.
            f) Interrupting-duty fault current.
         2) Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device:

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a) Voltage.
b) Interrupting-duty current (based on the applicable device operating time).
c) Comparison of calculated duties versus equipment ratings.

g. Available Fault Current Labels
1) Label must include the following information taken directly from short-circuit study:
a) Equipment designation.
b) Maximum available fault current.
c) Engineering report number, revision number, and issue date.
2) Available Fault Current Label data fields may be combined with Arc-Flash Hazard Labels such that each equipment requires one label.

3. Overcurrent Protection Device Coordination Study Section Contents:
a. Executive summary of study findings.
b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
c. Comments and recommendations for system improvements.
d. Report recommended settings of protective devices, ready to be applied in field. Use manufacturer's data sheets for recording recommended setting of overcurrent protective devices when available.
1) Phase and Ground Relays:
a) Device tag.
b) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
c) Recommendations on improved relaying systems, if applicable.
2) Circuit Breakers:
a) Adjustable pickups and time delays (long time, short time, and ground).
b) Adjustable time-current characteristic.
c) Adjustable instantaneous pickup.
d) Recommendations on improved trip systems, if applicable.
3) Fuses: Show current rating, voltage, and class.
e. Include all Time-Current Characteristic Curves prepared for the study.

4. Arc-Flash Incident Energy Study Section Contents:
a. Executive summary of study findings.
b. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
c. Recommendations to reduce arc-flash incident energy to less than 12 cal/cm^2 at all equipment. While reduction is not always feasible, understanding how to achieve reduction allows for informed decisions.
d. Incident Energy and Flash Protection Boundary Calculations:
1) Bolted fault magnitude.
2) Arcing fault magnitude.
3) Protective device clearing time.
4) Duration of arc.
5) Working distance.
6) Arc-flash boundary.

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7) Incident energy.

e. Arc Flash Hazard Labels.

1) Label must include the following information taken directly from arc-flash incident energy study:

a) Header:
If incident energy is 40 cal/cm^2 or more, header shall be RED with wording, “DANGER.”
If incident energy is less than 40 cal/cm^2, header shall be ORANGE with wording, "WARNING."

b) Equipment designation.

c) Arc-flash boundary (worst case).

d) Available incident energy (worst case).

e) Working distance.

f) Nominal voltage.

g) Restricted approach boundary.

h) Limited approach boundary.

i) Engineering report number, revision number, and issue date.

2) Labels shall not specify arc-flash PPE category level.

3.7 FIELD ADJUSTMENT FOR DEVICE COORDINATION

A. Adjust relay and protective device settings in accordance with recommended settings provided by coordination and/or arc-flash study.

B. Testing and adjusting shall be performed by qualified electrical testing and inspecting agency. Testing and adjustment shall be the responsibility of the Electrical Contractor or Owner’s Testing Agency as applicable and may be combined with electrical acceptance testing per NETA ATS as required by other sections of this project manual. Perform NETA tests and inspections for adjustable overcurrent protective devices.

C. Field adjustment shall be completed prior to application of arc-flash hazard warning labels.

3.8 LABELING OF AVAILABLE FAULT CURRENT

A. Provide one available fault current label for front cover of each equipment listed below:

1. Service equipment.
2. Switchboards.
3. Switchgear.
4. Panelboards.
5. Industrial control panels.
6. Industrial machinery.
7. Motor-control panels.
8. Motor controllers.
9. Elevator disconnecting means.
10. Elevator control panels.

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B. Labels shall be vinyl, weather- and UV-resistant, pressure-sensitive adhesive labels complying with NFPA 70E and NFPA 70 Section 110.21(B).

C. Machine print labels with no handwritten or field-applied markings.

D. Electrical Contractor shall install available fault current labels to equipment.

3.9 WARNING LABELING OF ARC-FLASH HAZARDS

A. Provide one arc-flash label for front cover of each section of equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in study, including each equipment listed below:
   1. Medium-voltage switchgear.
   2. Medium-voltage switches.
   3. Medium voltage transformers.
   4. Low-voltage switchgear.
   5. Switchboards.
   6. Panelboards.
   7. Motor-control centers.
   8. Motor controllers.
   9. Safety switches.
   10. Control panels.
   11. Enclosed circuit breakers.

B. Base arc-flash label data on highest values calculated at each location.

C. Labels shall be vinyl, weather- and UV-resistant, pressure-sensitive adhesive labels complying with NFPA 70E and NFPA 70 Section 110.21(B).

D. Machine print warning labels with no handwritten or field-applied markings.

E. Electrical Contractor shall install arc-flash labels to equipment.

END OF SECTION 26 05 73

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SECTION 26 22 13 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. Square-D
   2. Siemens
   3. Eaton Electrical Sector; Eaton Corporation
   4. ABB/General Electric Company; GE Energy Management – Electrical Distribution
   5. Or approved equal.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.
   1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:
1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.

E. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.

F. Coils: Continuous windings without splices except for taps.
1. Coil Material: Copper.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded.

G. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70, and list and label as complying with UL 1561.

B. Cores: One leg per phase.

C. Coils: Continuous windings without splices except for taps.
1. Coil Material Copper.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded.

D. Enclosure: Ventilated.
1. NEMA 250, Type 2: Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.

E. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

F. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

G. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

H. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

I. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

J. Wall Brackets: Manufacturer's standard brackets.

2.4 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
   1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases according to Section 033000 and anchor floor-mounted transformers according to manufacturer's written instructions.
   1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure transformer to concrete base according to manufacturer’s written instructions.

E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
   1. Visual and Mechanical Inspection.
      a. Inspect physical and mechanical condition.
      b. Inspect anchorage, alignment, and grounding.
      c. Verify that resilient mounts are free and that any shipping brackets have been removed.
      d. Verify the unit is clean.
      e. Perform specific inspections and mechanical tests recommended by manufacturer.
      f. Verify that as-left tap connections are as specified.
      g. Verify the presence of surge arresters and that their ratings are as specified.
   2. Electrical Tests:
      a. Measure resistance at each winding, tap, and bolted connection.
      b. Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
      c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.

d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

D. Remove and replace units that do not pass tests or inspections and retest as specified above.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 13

SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Service and distribution switchboards rated 600 V and less.
   2. Surge protection devices.
   3. Disconnecting and overcurrent protective devices.
   4. Identification.

1.2 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

B. Shop Drawings: For each switchboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
   5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   6. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.
   7. Include schematic and wiring diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: one (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMMON REQUIREMENTS

A. Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Contractor is responsible to coordinate ratings with results of Power System Study to be completed under section 260573, “Power System Studies.” Assembly listed by an NRTL for 100 percent interrupting capacity.

B. Emergency (Life Safety) System and Fire Pump System Selective Coordination: Provide devices capable of NEC-required selective coordination. Contractor is responsible to provide devices capable of NEC-required selective coordination in conjunction with results of Power System Study to be completed under section 260573, “Power System Studies.”

C. Provide arc-energy reduction in accordance with NEC 240.87 for applicable circuit breakers.

2.2 SWITCHBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. Siemens.
   2. ABB.
   3. Eaton Electrical Sector; Eaton Corporation.
   4. Square D.

B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

C. Comply with NEMA PB 2.

D. Comply with NFPA 70.

E. Comply with UL 891.

F. Front-Connected, Front-Accessible Switchboards:

G. Outdoor Enclosures: Type 3R.

1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.

H. Space Heaters: Factory-installed electric space heaters of sufficient wattage in each vertical section to maintain enclosure temperature above expected dew point.
1. Space-Heater Control: Thermostats to maintain temperature of each section above expected dew point.
2. Space-Heater Power Source: 120-V external branch circuit.

I. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

J. Buses and Connections: Three phase, four wire unless otherwise indicated.
1. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
2. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
3. Disconnect Links:
a. Provide main bonding jumper or system bonding jumper where indicated and as required by NFPA 70.
4. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.

2.3 SURGE PROTECTION DEVICES

A. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.

B. Include LED indicator lights for power and protection status.

C. Include surge counter.

D. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating shall be 100 kA per phase, as published by the SPD manufacturer.

E. Protection Modes and UL 1449 Voltage Protection Ratings (VPR): For grounded-wye, three-phase, four-wire circuits, VPR shall not exceed the following:
1. 480Y/277 V Systems:
a. Line to Neutral: 1200 V.
b. Line to Ground: 1200 V.
c. Neutral to Ground: 1200 V.
d. Line to Line: 2000 V.
2. 208Y/120 V Systems:
a. Line to Neutral: 700 V.
b. Line to Ground: 700 V.
c. Neutral to Ground: 700 V.

d. Line to Line: 1200 V.

F. Protection Modes and UL 1449 Voltage Protection Ratings (VPR): For 240/120-V, single-phase, three-wire circuits, VPR shall not exceed the following:
1. Line to Neutral: 700 V.
2. Line to Ground: 700 V.
3. Neutral to Ground: 700 V.
4. Line to Line: 1200 V.

G. SCCR: 200 kA rms symmetrical minimum.

H. Nominal Discharge Current (In): 20 kA minimum.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings, as required per Drawings:
a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long and short time adjustments.
d. Ground-fault pickup level, time delay, and I squared t response.
4. MCCB Features and Accessories:
a. Standard frame sizes, trip ratings, and number of poles.
b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
c. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
d. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

2.5 IDENTIFICATION

A. Switchboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside switchboard door, mounted in transparent card holder.

D. Provide typed circuit directory to reflect field installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.

B. Install switchboards and accessories according to NEMA PB 2.1.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.

D. Install filler plates in unused spaces of panel-mounted sections.

E. Install overcurrent protective devices, surge protection devices, and instrumentation.
1. Set field-adjustable switches and circuit-breaker trip ranges in accordance with recommended settings from Power System Study specified in Section 260573, “Power System Studies.”

F. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Acceptance Testing:
a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the

switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.

b. Test continuity of each circuit.

2. Test ground-fault protection of equipment for service equipment per NFPA 70.
3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
6. Arc-Energy-Reduction Protection System: For circuit breakers subject to NFPA 70 Article 240.87, performance test the arc-energy-reduction protection system when first installed in accordance with NFPA 70. Perform testing by primary current injection or another approved method. Document the testing and submit test results.

B. Switchboard will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 13

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Panelboards.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data for inclusion within Operation and Maintenance Manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Keys: Two spares for each type of panelboard cabinet lock.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.9 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

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

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush or Surface-mounted, dead-front cabinets as required for construction.
1. Rated for environmental conditions at installed location.
a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
2. Height: 84 inches maximum.
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and

shall have no exposed hardware.

4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

E. Incoming Mains Location: Top or Bottom as required for panel installation.

F. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

G. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
5. Subfeed Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Contractor is responsible to coordinate ratings with results of Power System Study to be completed under section 260573, “Power System Studies.” Assembly listed by an NRTL for 100 percent interrupting capacity.

J. Emergency (Life Safety) System and Fire Pump System Selective Coordination: Provide devices capable of NEC-required selective coordination. Contractor is responsible to provide devices capable of NEC-required selective coordination in conjunction with results of Power System Study to be completed under section 260573, “Power System Studies.”

K. Surge Protective Device (SPD): Factory installed as an integral part of indicated panelboards. Provide Type 2 SPD listed to UL 1449.

2.2 PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
1. ABB.
2. Eaton Electrical Sector; Eaton Corporation.
3. Square D (Basis of design).

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit Breaker or Main Lugs only as indicated on the contract drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. ABB.
   2. Eaton Electrical Sector; Eaton Corporation
   3. Square D (Basis of design)

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or main lugs only as indicated on the contract drawings.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. Inverse time-current element for low-level overloads.
      b. Instantaneous magnetic trip element for short circuits.
      c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   2. Adjustable instantaneous-Trip Circuit Breakers: Magnetic trip element with front mounted, field -adjustable trip setting.
   3. Electronic Trip Circuit Breakers:
      a. RMS sensing.
      b. Field-replaceable rating plug or electronic trip.
      c. Field-Adjustable Settings (as required per Drawings):
         1) Instantaneous trip.
         2) Long- and short-time pickup levels.
         3) Long and short time adjustments.
         4) Ground-fault pickup level, time delay, and I squared T response.
   4. MCCB Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.
      b. Breaker handle indicates tripped status.

c. UL listed for reverse connection without restrictive line or load ratings.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
f. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

B. SPD.
1. Include LED indicator lights for power and protection status.
2. Include surge counter.
3. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating shall be 100 kA per phase, as published by the SPD manufacturer.
4. Protection Modes and UL 1449 Voltage Protection Ratings (VPR): For grounded-wye, three-phase, four-wire circuits, VPR shall not exceed the following:
a. 480Y/277 V Systems:
1) Line to Neutral: 1200 V.
2) Line to Ground: 1200 V.
3) Neutral to Ground: 1200 V.
4) Line to Line: 2000 V.
b. 208Y/120 V Systems:
1) Line to Neutral: 700 V.
2) Line to Ground: 700 V.
3) Neutral to Ground: 700 V.
4) Line to Line: 1200 V.
5. Protection Modes and UL 1449 Voltage Protection Ratings (VPR): For 240/120-V, single-phase, three-wire circuits, VPR shall not exceed the following:
a. Line to Neutral: 700 V.
b. Line to Ground: 700 V.
c. Neutral to Ground: 700 V.
d. Line to Line: 1200 V.
6. SCCR: 100 kA rms symmetrical minimum.
7. Nominal Discharge Current (In): 20 kA minimum.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

D. Provide typed circuit directory to reflect field installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NECA 407, NEMA PB 1.1.

C. Mount top of trim as required for existing conditions.

D. Mount panelboard cabinet plumb and rigid without distortion of box.

E. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

F. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

G. Make grounding and bonding connections in accordance with NFPA 70. Provide main bonding jumper or system bonding jumper only where indicated and where required by NFPA 70.Install filler plates in unused spaces.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Client Agency's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical tests specified in NETA ATS for panelboards and molded-case circuit breakers, as applicable. 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.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 14 26

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Standard-grade receptacles, 125 V, 20 A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. Toggle switches, 120/277 V, 20 A.
5. Wall-Box Occupancy sensors.
6. Wall plates.
7. Emergency Lighting Control Relays

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protectivAe device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Toggle switches and receptacles shall be Hubbell, Leviton, or approved equal.

C. Occupancy and timer switches shall be Lutron.

D. Comply with NFPA 70.

E. RoHS compliant.

F. Comply with NEMA WD 1.

G. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
   1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
   2. Devices shall comply with requirements in this Section.

H. Devices for Owner-Furnished Equipment:
   1. Receptacles: Match plug configurations.
   2. Cord and Plug Sets: Match equipment requirements.

I. Device Color:
   1. Wiring Devices Connected to Normal Power System: as directed by Architect.

J. Wall Plate: stainless steel.

K. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A

1. Description: Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.

B. Weather-Resistant Duplex Receptacle, 125 V, 20 A
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

C. Tamper-Resistant Duplex Receptacles, 125 V, 20 A
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate oı when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" articles.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.3 USB RECEPTACLES

A. USB Charging Receptacles
1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
2. USB Receptacles: Dual USB Type A, Type C,
3. Standards: Comply with UL 1310 and USB 3.0 devices.

2.4 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A, GFI

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A WP,GFI:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498 and UL 943 Class A.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.5 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A
1. Standards: Comply with UL 20 and FS W-S-896.

B. Three-Way Switches, 120/277 V, 20 A
1. Comply with UL 20 and FS W-S-896.

C. Four-Way Switches, 120/277 V, 20 A
1. Standards: Comply with UL 20 and FS W-S-896.

D. Pilot-Light, Single-Pole Switches: 120/277 V, 20 A
1. Description: Illuminated when switch is on.
2. Standards: Comply with UL 20 and FS W-S-896.

E. Lighted Single-Pole Switches, 120/277 V, 20 A
1. Description: Handle illuminated when switch is on.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.6 OCCUPANCY SENSORS

A. In-Wall Sensor Light Switch, Passive Infrared
1. Lutron design basis.
a. Occupancy with 0-10v Dimming, Lutron MRF2S-8SD010-*,drawing designation SMD

2. Occupancy, Lutron MRF2S-8SS-*, drawing designation SM.Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
3. Standards: Comply with UL 20.
4. Connections: Hard wired.
5. Rated 960 W at 120 V ac for tungsten lighting, 8 A at 120 V ac or 8 A at 277 V ac for fluorescent or LED lighting, and 1/6 hp at 120 V ac.
6. Adjustable time delay of 1, 5, 10, 15, 20, minutes.
7. Able to be locked to Manual-On mode.
8. Occupancy or vacancy modes
9. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc .
10. 0-10V LED driver load dimming

B. General Requirements:
   1. Passive Infrared Sensing:
      a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
      b. Passive infrared coupled with technology for sensing fine motions; Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.

C. Wall Switch Occupancy/Vacancy Sensors; Lutron Maestro Series:
   1. General Requirements:
      a. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
      b. Switches at point of minimum energy to maximize relay life, actively adapting to variations in relay timing.
      c. Suitable for incandescent, halogen, electronic low-voltage, magnetic low-voltage, compact fluorescent, LED, magnetic fluorescent, electronic fluorescent, and fan loads.
   2. Passive Infrared Wall Switch Combination Occupancy/Vacancy Sensors:
      a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
      b. Adjustable sensitivity (high, low presets).
      c. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be adaptive utilizing occupant feedback; Lutron Smart Ambient Light Detection.
      d. Selectable option to inhibit automatic turn-on of lights after manual-off operation while room is occupied for applications such as presentation viewing in conference rooms and classrooms; when room is vacated, returns to normal automatic-on operation after time delay period.
      e. Product(s):
         1) Passive Infrared Wall Switch Occupancy/Vacancy Sensor; Lutron Maestro Series, Model MRF2S-8SS: 8 A lighting (120-277 V), 3 A fan (120 V); coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; compatible with standard 3-way mechanical switches; multi-

location capability using companion switches (up to nine companion switches may be connected).

D. 0-10 V Wall Dimmer Occupancy Sensors; SMD.Description Lutron Maestro 0-10 V Dimmer Sensor Series:
   1. General Requirements;
      a. Compatible with sourcing electronic 0-10 V ballasts/drivers, as per IEC 60929 Annex E.2 0-10 V protocol.
      b. Adjustable sensitivity (high, medium, low, and minimum presets).
      c. Adjustable high/low end trims.
      d. Selectable dimming curve (linear or square law).
      e. Dimmer Features: Locked preset, fade-to-on, fade-to-off.
      f. Turns off lighting after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area. Provide adjustable timeout settings of 1, 5, 15, and 30 minutes.
      g. Selectable option to enable low light feature (automatic-on when ambient light is below threshold). Ambient light threshold to be selectable as either adaptive utilizing occupant feedback (Lutron Smart Ambient Light Detection) or as fixed (high, medium, low, and minimum presets); applicable for auto-on only.
      h. Fades lights to off over period of 10 seconds to warn occupant of impending load turn-off.
      i. Provides visual alert for miswire and incompatible load.
   2. Passive Infrared 0-10 V Wall Dimmer Combination Occupancy/Vacancy Sensors:
      a. Programmable to operate as an occupancy sensor (automatic-on and automatic-off) or a vacancy sensor (manual-on and automatic-off).
      b. Product(s):
         1) Passive Infrared 0-10 V Wall Dimmer Occupancy/Vacancy Sensor; Lutron Maestro 0-10 V Dimmer Sensor Series, Model MRF2S-8SD010: 0-10 V control for 0-10 V fluorescent ballasts/LED drivers (8 A load at 120-277 V, 50 mA max control current); coverage of 900 square feet (81 sq m) with mounting height of 4 feet (1.2 m); 180 degree field of view; compatible with standard 3-way mechanical switches; multi-location capability using companion switches (up to nine companion switches may be connected).

2.7 TIMER LIGHT SWITCH

A. Digital Timer Light Switch
   1. Lutron, Leviton, Hubbel, or approved equal
   2. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10 minute increments.
   3. Standards: Comply with UL 20.
   4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.

2.8 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.9 EMERGENCY LIGHTING CONTROL UNIT

A. Description: NC, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.

Design basis LVS Controls EPC-2-D, Bodine, Wattstopper, or approved equal.
1. Coil Rating 120/277V
2. 0-10V dimming disconnect contacts.
3. Load rating 120-277v, 20amp.
4. Ballast load 20Amp 120-277vac
5. Incandescent load 1200w @120v, 1500w @277v.
6. Rating UL94-5va
7. 5 year warranty

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles [up], and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled, 3/32” lettering, with clear backing on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Tests for Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

D. Test for Emergency Lighting Control Relay
1. De-energize normal source and verify emergency operation.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 6 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to 15 minutes.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 26 27 26

SECTION 26 28 16 - ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fusible switches.
   2. Nonfusible switches.
   3. Enclosures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.
   1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

C. Comply with NFPA 70.

1.1 FUSIBLE SWITCHES

A. Type HD, Heavy Duty:
1. Single throw.
2. Three pole.
3. 240 600-V ac.
4. 200 A and smaller.

2.2 NONFUSIBLE SWITCHES

A. Acceptable manufacturers Square-D, Eaton, Siemens, and ABB

B. Type HD, Heavy Duty, Three Pole, 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 and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R, 12).

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches: Provide enclosures at installed locations with the following environmental ratings.
1. Outdoor Locations: NEMA 250, Type 3R.
2. Indoor Locations: NEMA 250, Type 12.

3.2 INSTALLATION

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.

B. Install individual wall-mounted switches with tops at uniform height unless otherwise indicated.

C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Comply with NFPA 70 and NECA 1.

E. Install fuses in fusible devices.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections for Switches:
   1. Visual and Mechanical Inspection:
      a. Inspect physical and mechanical condition.
      b. Inspect anchorage, alignment, grounding, and clearances.
      c. Verify that the unit is clean.
      d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
      e. Inspect bolted electrical connections for high resistance using one of the two following methods:
         1) Use a low-resistance ohmmeter.
            a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
         2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
            a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
      f. Verify correct phase barrier installation.

g. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:
   a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
   b. DPerform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
   c. Perform ground fault test according to NETA ATS 7.14 “Ground Fault Protection Systems, Low-Voltage”.

C. Enclosed switches will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.
   1. Test procedures used.
   2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
   3. List 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 26 28 16

SECTION 26 32 13- ENGINE GENERATORS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes packaged engine-generator sets for standby power supply with the following features:
   1. Natural Gas engine.
   2. Unit-mounted cooling system.
   3. Unit-mounted and/or Remote-mounting control and monitoring.
   4. Performance requirements for sensitive loads.

B. Related Sections include the following:
   1. Division 26 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and-stopping signals for engine-generator sets.

1.2 DEFINITIONS

A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.3 SUBMITTALS

A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
   1. Complete generator and generator overcurrent protective-device data required for the preliminary and final power system studies specified in Section 260573 “Power System Studies.” Include generator reactances and time constants, decrement characteristics, short-circuit current characteristics, thermal-damage characteristics, excitation system characteristics affecting fault-current contribution, generator circuit-breaker ratings, trip-unit type and available settings, and time-current characteristic curves for generator protective devices.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.

2. Vibration Isolation Base Details: Signed and sealed by a qualified professional engineer. Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include base weights.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Qualification Data: For manufacturer and testing agency.

D. Source quality-control test reports.
1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01, include the following:
1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

G. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles (321 km) of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.

C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.
   1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Comply with ASME B15.1.

G. Comply with NFPA 37.

H. Comply with NFPA 70.

I. Comply with NFPA 110 requirements for Level 1 emergency power supply system.

J. Comply with UL 2200.

K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

L. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.5 PROJECT CONDITIONS

A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
   1. Ambient Temperature:-5 to 40 deg C.
   2. Relative Humidity: 0 to 95 percent.
   3. Altitude: Sea level to 1000 m.

1.6 COORDINATION

A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate generator, generator circuit breaker, and protective-device characteristics and settings with the preliminary and final power system studies specified in Section 260573 “Power System Studies.” Do not release equipment for manufacture until required preliminary study information has been submitted and reviewed. Provide equipment and protective-device settings necessary to achieve the short-circuit, selective-coordination, and arc-flash requirements established by the Contract Documents and final power system study.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by one of the following, or approved equal:
   1. Caterpillar (basis-of-design).
   2. Onan/Cummins Power Generation.

2.2 ENGINE-GENERATOR SET

A. Factory-assembled and-tested, engine-generator set.

B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
   1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

C. Capacities and Characteristics:

1. Power Output Ratings: Nominal ratings as indicated, with capacity as required to operate as a unit as evidenced by records of prototype testing.
2. Output Connections: Three-phase, four wire.
3. Nameplates: For each major system component to identify manufacturer's name and address, model and serial number.

D. Generator-Set Performance:
1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
7. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
8. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.3 ENGINE

A. Fuel:
1. Fuel: Natural Gas.

B. Rated Engine Speed: 1800 rpm.

C. Lubrication System: The following items are mounted on engine or skid:
1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

D. Coolant Jacket Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity.

E. Governor: Adjustable isochronous, with speed sensing.

F. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
   1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
   2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
   3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
   4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
   5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
      a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and non collapsible under vacuum.
      b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

G. Muffler/Silencer: Critical type, and flexible connector, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
   1. Minimum sound attenuation of 25 dB at 500 Hz.
   2. Sound level measured at a distance of 10 feet (3 m) from exhaust discharge after installation is complete shall be 85 dBA or less.

H. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

I. Starting System: 24V electric, with negative ground.
   1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
   2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
   3. Cranking Cycle: 60 seconds.
   4. Battery: Adequate capacity within ambient temperature range specified in Part 1 "Project Conditions" Article to provide specified cranking cycle at least three times without recharging.
   5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
   6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Include accessories required to support and fasten batteries in place.
   7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.

8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
   a. Operation: Equalizing-charging rate of 10A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
   d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
   e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
   f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.4 CONTROLS – GENERATOR SET MOUNTED

A. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.

B. Environmental
   1. The generator set control shall be tested and certified to the following environmental conditions:
      a. -40°C to +70°C Operating Range
      b. -50°C to +85°C Storage Range
      c. Humidity (condensing/noncondensing)
      d. IP23 protection for control panel
      e. Electromagnetic Capability (2014/30/EU, IEC 61000)
   2. The following functionality shall be integral to the control panel.
      a. The control shall include microprocessor based electronic control unit(s).
      b. Display of critical generator set mechanical and electrical data.
      c. Digital NFPA110 local annunciator
      d. Audible horn for alarm and shutdown with horn silence button
      e. Standard ISO labeling
      f. Remote start/stop control
      g. Local run/off/auto control
      h. Cooldown timer
      i. Speed adjust
      j. Lamp test

k. Emergency stop push button
l. Voltage adjust
m. Voltage regulator V/Hz slope- adjustable
n. Password protected system programming
o. Generator Set Total Count and Online Status
p. Dead Bus Arbitration
q. Load Sense Load Demand
r. Synchronization
s. Load Sharing
t. Generator Set Circuit Breaker Control & Status
u. Generator/Bus Phase Difference (Sync Scope)
v. Frequency and Voltage Difference (P&ID Tuning)
w. Sync Mode Selection (Auto, Manual, Check, Off)
x. Utility/Bus Monitoring
y. Programmable Cycle Timer
z. Programmable kW Relay
aa. Start Signal Monitoring (NFPA 70: NEC 2020)

C. Digital Monitoring Capability
1. The controls shall provide the following digital readouts for the engine and generator, as applicable.
2. Engine
a. Engine Status
b. Engine Oil Pressure
c. Engine Oil Temperature
d. Engine Coolant Temperature
e. Engine Crankcase Pressure
f. Engine Boost Pressure
g. Engine Atmospheric Pressure
h. Engine Turbo Inlet Pressure
i. Engine RPM
j. Desired Engine RPM
k. Battery volts
l. Engine hours
m. Engine crank attempt counter
n. Engine successful start counter
o. Service maintenance interval
p. Real time clock
q. Engine exhaust stack temperature
r. Cooldown Time Remaining
s. Number of cylinders
t. Engine Intake Manifold (Air flow and air pressure)
u. Engine air to fuel differential pressure
v. Aftercooler Inlet and Outlet Temperatures
w. Left/right turbo inlet pressures
x. Instantaneous Fuel Use

y. Total Fuel
z. Fuel Level
aa. Fuel Energy Content
bb. Bund Level
cc. Engine Fuel Priming
dd. Fuel Correction Factor
ee. Fuel Specific Gravity
ff. Specific Heat Ratio
gg. Fuel Quality
hh. Fuel Gas Pressure
ii. Engine Gas Blending
jj. SCR Tank Level and Temperature
kk. SCR Air Assist Pressure
ll. SCR Catalyst Temperature
mm. SCR Exhaust Differential Pressure
nn. Soot Level
oo. SCR Status
pp. DEF Dosing Temperature
qq. Total DEF Used
rr. Time Since Last Inducement
ss. Time Until Inducement
tt. SCR System Hydrocarbon Temperature
uu. SCR Override Mode
vv. SCR Override Time Remaining
ww. Turbo Compressor Inlet Temperature
xx. Turbo Intake and Outlet Temperatures
yy. Engine Derate %
zz. Time to Final Inducement
aaa. Engine Air to Fuel Ratio
bbb. Engine Cylinder Detonation Level
ccc. Engine Cylinder Ignition Timing
ddd. Exhaust NOx Level
eee. Engine Idle/Rated
fff. Engine Fuel Load/Unload
ggg. Engine Inducement Override

3. Generator
   a. Generator AC volts (Line to Line, Line to Neutral and Average)
   b. Generator AC current (Avg and Per Phase)
   c. Generator AC Frequency
   d. Generator kW (Total and Per Phase)
   e. Generator kVA (Total)
   f. Generator kVAR (Total and Per Phase)
   g. Power Factor (Avg, Per Phase, and Type)
   h. Total kW-hr
   i. Total kVAR-hr
   j. % kW

k. % kVA
l. % kVAR
m. Trip kW-hr
n. Generator bearing temperature
o. Generator stator winding temperature
p. Rated voltage, frequency, real power, apparent power, reactive power
q. Bus AC Frequency
r. Average Bus L-L, L-N AC Voltage
s. Phase A, B, C Bus L-L, L-N AC Voltage
t. Total kVArh Export and Import
u. Trip kVArh Export and Import
v. Generator breaker status
w. Utility Avg Line to Line AC RMS Voltage and Frequency
x. Unit Number

D. Alarms and Shutdowns
1. The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:
2. Engine Alarm/Shutdown
a. Low oil pressure alarm/shutdown
b. Low Idle Low engine Oil Pressure alarm/shutdown
c. High coolant temperature alarm/shutdown
d. Low coolant temperature alarm/shutdown
e. Loss of coolant shutdown
f. Overspeed shutdown
g. Underspeed alarm/shutdown
h. Overcrank shutdown
i. Emergency stop shutdown
j. Low coolant temperature alarm
k. Low battery voltage alarm
l. High battery voltage alarm
m. Control switch not in auto position alarm
n. Battery charger failure alarm
o. Air Damper Shutdown
p. Engine speed-Generator Output Frequency Mismatch alarm
q. High gas pressure alarm/shutdown
r. Low gas pressure alarm/shutdown
3. Generator Alarm/Shutdown
a. Generator over voltage
b. Generator under voltage
c. Generator over frequency
d. Generator under frequency
e. Generator reverse power (real and reactive)
f. Generator overcurrent
g. Generator current balance

h. Generator voltage balance
i. Overload Alarm
j. Generator over reactive power
k. Generator under reactive power
l. Generator open phase detection

4. Voltage Regulator Alarm/Shutdown
   a. Loss of excitation alarm/shutdown
   b. Instantaneous over excitation alarm/shutdown
   c. Time over excitation alarm/shutdown
   d. Rotating diode failure
   e. Loss of sensing
   f. Loss of PMG

E. Inputs and Outputs
   1. Programmable Digital Inputs
      a. The Controllers shall include the ability to accept programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.
   2. Programmable Discrete Outputs
      a. The controllers shall include the ability to operate discrete outputs compatible with ATS to enable load shedding commands .

F. Paralleling
   1. The controller shall be capable of automatically synchronizing and paralleling two generator sets to a common bus. Paralleling shall be accomplished without the need for a system master controller. Paralleling functions shall include:
   2. Modes of Operation:
      a. Automatic paralleling
      b. Manual paralleling
      c. Semi-Automatic paralleling
   3. Paralleling Features
      a. Dead bus arbitration
      b. Automatic synchronization
      c. Real and reactive load sharing
      d. Load sense/load demand with spinning reserve, sequence strategy, proactive add, number of redundant units, and event based redundancy
      e. Load shed-single stage
      f. Load add-single stage
      g. Base loading with utility
      h. Power factor control
      i. Reactive Load (Var) control
      j. Dead Field Paralleling
      k. Automatic Mains Failure (AMF) in open transition
      l. Generator breaker control
      m. Failsafe Operation for Paralleled Generator Sets (For loss of communications)

G. Maintenance
1. All engine, voltage regulator, control panel and accessory units shall be accessible through electronic service tools. The following maintenance functionality shall be integral to the generator set control
a. Engine running hours display
b. Service maintenance interval (running hours or calendar days)
c. Engine crank attempt counter
d. Engine successful starts counter
e. At least 40 events are stored in control panel memory
f. Chronological status event log capable of displaying a sequence of event leading up to a generator set shutdown
g. Programmable cycle timer that starts and runs the generator for a predetermined time. Each sequence shall have the following programmable set points:
1) Day of week
2) Time of day to start
3) Duration of cycle

H. Remote Communications
1. Remote Communications
a. The generator set control shall include Modbus TCP communications via Ethernet 100BASE-T. Webserver capability available from HMI, generator set controller, and paralleling controller via Ethernet

I. Annunciation
1. Remote Annunciator (NFPA 99/110, CSA 282)
a. Provide a remote annunciator to meet the requirements of NFPA 110, Level1.
b. The annunciator shall incorporate ring-back capability so that after silencing the initial alarm, any subsequent alarms will sound the horn.
c. Ability to be located up to 500 ft from the generator set.
d. The annunciator shall provide remote annunciation of all points listed below:
1) Overcrank
2) Low coolant temperature
3) High coolant temperature warning
4) High coolant temperature shutdown
5) Low oil pressure warning
6) Low oil pressure shutdown
7) Overspeed
8) Low coolant level
9) EPS supplying load
10) Control switch not in auto
11) High battery voltage
12) Low battery voltage
13) Battery charger AC failure
14) Emergency stop
15) ATS Remote Start wiring failure
16) Load shedding warning

17) Load shedding active

J. Sequence of Operations:
1. Upon loss of utility, any of the three (3) automatic transfer switch(es) (ATS) and fire pump controllers shall send a group start signal to the generator set system. Each generator set in the system shall automatically start and accelerate to rated speed and voltage. The first generator set to reach rated speed and voltage shall automatically close its circuit breaker, energizing the generator bus. At this point, the first priority load add signal shall be enabled, allowing emergency loads to be energized. Each additional generator set in the system shall automatically drive the output voltage, frequency, and phase to match the bus, and close the generator circuit breaker once the conditions have been met. As each subsequent generator is brought on-line, an additional load add signal shall be enabled, allowing additional loads to be added to the bus.
2. Once all generator sets are on-line, the paralleling controller shall actively monitor real (kW) and reactive (kVA) load requirements of the system, and adjust the generator set output to maintain balanced loading.
3. The controller shall also include logic to automatically sequence the generator sets based on the total load requirement of the system. If the load exceeds a minimum reserve kW threshold, additional generator sets will automatically start, synchronize, and close the generator circuit breaker. If the site load falls below a reserve kW threshold, a generator set will automatically unload, open the generator circuit breaker, run cooldown timer, and shutdown.
4. If only one generator is available due to maintenance, fault, or failure, the paralleling control system shall alarm at the facility control room when load exceeds 60% of the available generator's rated capacity. If only one generator is available and load exceeds 90% of the remaining generator's rated capacity, the paralleling control system shall initiate load shedding. Load shedding shall transfer the 1200 A service entrance ATS off the emergency generator bus. The remaining emergency branch ATS and fire pump controller loads shall remain served by the available generator. Generator controls shall automatically reset load-shed status and restore normal paralleling operation when both generators are available or by the operator resetting the load shedding command.
5. Once utility power has been restored, the ATS and fire pump controller shall remove the group start signal. The generator set will open the generator circuit breaker, and the generator set will enter cooldown mode. At the expiration of the cooldown timer, the generator set shall automatically shutdown.

K. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator disconnect switch or circuit breaker, and other indicated components shall be grouped in a combination control and power panel. Control and monitoring section of panel shall be isolated from power sections by steel barriers. Panel features shall include the following:
1. Wall-Mounting Cabinet Construction: Rigid, self-supporting steel unit complying with NEMA ICS 6. Power bus shall be copper. Bus, bus supports, control wiring, and temperature rise shall comply with UL 891.
2. Current and Potential Transformers: Instrument accuracy class.

L. Indicating and Protective Devices and Controls: As required by NFPA 110 for Level 1 system, and the following:
   1. AC voltmeter.
   2. AC ammeter.
   3. AC frequency meter.
   4. DC voltmeter (alternator battery charging).
   5. Engine-coolant temperature gage.
   6. Engine lubricating-oil pressure gage.
   7. Running-time meter.
   8. Ammeter-voltmeter, phase-selector switch(es).
   9. Generator-voltage adjusting rheostat.
   10. Start-stop switch.
   11. Overspeed shutdown device.
   12. Coolant high-temperature shutdown device.
   13. Coolant low-level shutdown device.
   14. Oil low-pressure shutdown device.
   15. Generator overload.

M. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

N. Common Remote Audible Alarm: Comply with NFPA 110 requirements for Level 1 systems. Include necessary contacts and terminals in control and monitoring panel.
   1. Overcrank shutdown.
   2. Coolant low-temperature alarm.
   3. Control switch not in auto position.
   4. Battery-charger malfunction alarm.
   5. Battery low-voltage alarm.

O. Common Remote Audible Alarm: Signal the occurrence of any events listed below without differentiating between event types. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset.
   1. Engine high-temperature shutdown.
   2. Lube-oil, low-pressure shutdown.
   3. Overspeed shutdown.
   4. Remote emergency-stop shutdown.
   5. Engine high-temperature prealarm.
   6. Lube-oil, low-pressure prealarm.
   7. Fuel tank, low-fuel level.
   8. Low coolant level.

P. Remote Emergency-Stop Switch: surface; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation. NEMA-3R rated exterior applications, NEMA-1 interior applications, one each per generator.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
   1. Frame Sizes: Quantity and nominal ratings as indicated on contract drawings
   2. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
   3. Shunt Trip: Connected to trip breaker when generator set is shut down by other protective devices.
   4. Mounting: Adjacent to or integrated with control and monitoring panel.
   5. Trip Unit Settings and Adjustment Ranges: Provide trip units having functions and adjustment ranges necessary to achieve selective coordination and generator protection as determined by the power system studies specified in Section 260573. Final protective-device settings shall be those established by the approved final power system study.

B. Ground-Fault Indication: Comply with NFPA 70, "Emergency System" signals for ground-fault. Integrate ground-fault alarm indication with other generator-set alarm indications.

C. Provide arc-energy reduction in accordance with NEC 240.87 for applicable circuit breakers.

D. Generator Protector: Provide microprocessor-based unit which shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other generator-set protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector shall perform the following functions:

   1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other generator-set malfunction alarms.
   2. Under single or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.
   3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the generator set.
   4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.

C. Electrical Insulation: Class H or Class F.

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.

E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Enclosure: dripproof.

G. Instrument Transformers: Mounted within generator enclosure.

H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
2. The regulator shall include electronic build-up and overcurrent protection. It shall incorporate 1:1 volts per hertz characteristics with the regulated voltage a linear function proportional to frequency over a 30 to 70 hertz range.

I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

K. Subtransient Reactance: 12 percent, maximum.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description: Sound attenuated, vandal-resistant, weatherproof steel housing, wind resistant up to 100 mph (160 km/h). Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

B. Description: Prefabricated or pre-engineered walk-in enclosure with the following features:
1. Construction: Galvanized-steel, metal-clad, integral structural-steel-framed building erected on concrete foundation.
2. Structural Design and Anchorage: Comply with ASCE 7 for wind loads.
3. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents.
4. Hinged Doors: With padlocking provisions.
5. Ventilation: Louvers equipped with bird screen and filter arranged to permit air circulation while excluding exterior dust, birds, and rodents.
6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine-generator-set components.
7. Muffler Location: Within enclosure.

8. Sound Attenuation: The enclosure shall provide a maximum sound level of 75 dBA, measured at 23 feet from the enclosure.
9. Load Center: Provide factory installed and wired 125A, 120/240V, 1-Phase load center.

C. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

D. Convenience Outlets: Factory wired, GFCI. Arrange for external electrical connection.

2.8 SOURCE QUALITY CONTROL

A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.

B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
2. Full load run.
3. Maximum power.
4. Voltage regulation.
5. Transient and steady-state governing.
6. Single-step load pickup.
7. Safety shutdown.
8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
9. Report factory test results within 10 days of completion of test.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions and with NFPA 110.

B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

C. Install packaged engine generator with restrained spring isolators having a minimum deflection of 1-inch on 4-inch- (100-mm-) high concrete base. Secure sets to anchor bolts installed in concrete bases.

D. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Division 23 Sections. Drawings indicate general arrangement of piping and specialties.

B. Connect fuel piping to engines with a gate valve and union and flexible connector.
   1. Natural-gas piping, valves, and specialties for gas distribution are specified in Division 23 Section "Facility Natural-Gas Piping."

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

A. Identify system components according to Division 23 Section "Identification for HVAC Piping and Equipment" and Division 26 Section "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. 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.

C. Perform tests and inspections and prepare test reports.
   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. Tests and Inspections:
   1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
   3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
      a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
      b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
      c. Verify acceptance of charge for each element of the battery after discharge.
      d. Verify that measurements are within manufacturer's specifications.
   4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
   5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
   6. Exhaust Emissions Test: Comply with applicable government test criteria.
   7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
   8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
   9. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations along the property line of the site, and compare measured levels with required values.
   10. Arc-Energy-Reduction Protection System: For circuit breakers subject to NFPA 70 Article 240.87, performance test the arc-energy-reduction protection system when first installed in accordance with NFPA 70. Perform testing by primary current injection or another approved method. Document the testing and submit test results.

E. Coordinate tests with tests for transfer switches and run them concurrently.

F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.

G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

J. Test generator synchronization controls and functionality as well as automatic load shedding controls as described in Sequence of Operations section.

K. Remove and replace malfunctioning units and retest as specified above.

L. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

M. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 32 13

SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes automatic transfer switches rated 600 V and less, including the following:
   1. Bypass/isolation switches.
   2. Remote annunciator system.
   3. Remote annunciator and control system.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
   2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
   3. Submit transfer-switch and integral overcurrent protective-device data required for the preliminary power system study specified in Section 260573 “Power System Studies” with the equipment submittal. Include short-circuit current ratings, short-time withstand ratings, overcurrent protective-device types and available settings, time-current characteristic curves, and other data required for the study. Do not release equipment for manufacture until the preliminary power system study has been submitted and reviewed, unless specifically authorized in writing by the Engineer.

B. Shop Drawings:
   1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
   2. Include material lists for each switch specified.
   3. Single-Line Diagram: Show connections between transfer switch, bypass/isolation switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
   4. Riser Diagram: Show interconnection wiring between transfer switches, bypass/isolation switches, annunciators, and control panels.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
   1. Include the following:
      a. Features and operating sequences, both automatic and manual.
      b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Member company of NETA.
      a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: One (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following or approved equal:
   1. ASCO.
   2. ONAN/Cummins.
   3. Eaton Electrical Sector; Eaton Corporation.

2.2 PERFORMANCE REQUIREMENTS

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

B. Comply with NEMA ICS 1.

C. Comply with NFPA 110.

D. Comply with UL 1008 unless requirements of these Specifications are stricter.

E. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer.

F. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

Transfer switch and complete assembly shall have a short-circuit current rating and withstand and closing rating adequate for the available fault current and the upstream overcurrent protective device at the installation location. Contractor shall coordinate ratings with the results of the Power System Study specified in Section 260573 “Power System Studies.”

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
2. Short-time withstand capability for 30 cycles.

G. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.

H. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

I. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

J. Service-Rated Transfer Switch:

1. Comply with UL 869A and UL 489.
2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
3. In systems with a neutral, the bonding connection shall be on the neutral bus.
4. Provide removable link for temporary separation of the service and load grounded conductors.
5. Surge Protective Device: Service rated.
6. Ground-Fault Protection: Comply with UL 1008 for normal bus.
7. Service Disconnecting Means: Externally operated, manual mechanically actuated.
8. Circuit breaker shall be fully rated to interrupt symmetrical short-circuit current available at terminals. Contractor is responsible to coordinate ratings with results of Power System Study to be completed under section 260573, “Power System Studies.” Assembly listed by an NRTL for 100 percent interrupting capacity.
9. Provide devices capable of NEC-required selective coordination. Contractor is responsible to provide devices capable of NEC-required selective coordination in conjunction with results of Power System Study to be completed under section 260573, “Power System Studies.”
10. Provide arc-energy reduction in accordance with NEC 240.87 for applicable circuit breakers.

K. Neutral Switching: Where four-pole switches are indicated, provide a fully rated neutral pole switched simultaneously with the phase poles. Transfer-switch construction and neutral switching sequence shall maintain the grounding and separately derived system arrangement indicated on the Drawings and shall not result in objectionable current on grounding paths.

L. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.

M. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

N. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 260553 "Identification for Electrical Systems."
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.

O. Enclosures: General-purpose NEMA 250, Type 1 for indoor and Type 3R for outdoor switches, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.3 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

A. Comply with Level 1 equipment according to NFPA 110.

B. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
   2. Switch Action: Double throw; mechanically held in both directions.
   3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
   4. Conductor Connectors: Suitable for use with conductor material and sizes.
   5. Material: Hard-drawn copper, 98 percent conductivity.
   6. Main and Neutral Lugs: Compression type.
   7. Ground Lugs and Bus-Configured Terminators: Compression type.
   8. Connectors shall be marked for conductor size and type according to UL 1008.

C. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
   1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.

D. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
   1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
   2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
   3. Fully automatic break-before-make operation with center off position.

E. Electric Nonautomatic Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

F. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.

G. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel, as applicable.

H. Automatic Transfer-Switch Controller Features:
   1. Controller operates through a period of loss of control power.
   2. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
   3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
   4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
   5. Test Switch: Simulate normal-source failure.
   6. Switch-Position Pilot Lights: Indicate source to which load is connected.
   7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
      a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
      b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."

   8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.

9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
11. Engine Shutdown Contacts: Instantaneous; shall initiate shutdown sequence at remote engine-generator controls after retransfer of load to normal source.
12. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.

I. 1200 Amp Service-Entrance Transfer Switch: Provide control inputs, relays, programming, and accessories required to receive load-shed and load-restore signals from the generator paralleling control system. Upon receipt of a load-shed signal, transfer the load from the emergency source to the normal source when the normal source is available, or disconnect the load from the emergency source when the normal source is unavailable. Automatically permit restoration of the load upon receipt of the load-restore signal. Coordinate sequence of operation with Section 263213 “Engine Generators.”

2.4 TRANSFER SWITCH ACCESSORIES

A. Bypass/Isolation Switches:
1. Source Limitations: Same manufacturer as transfer switch in which installed.
2. Comply with requirements for Level 1 equipment according to NFPA 110.
3. Description: Manual type, arranged to select and connect either source of power directly to load, isolating transfer switch from load and from both power sources. Include the following features for each combined automatic transfer switch and bypass/isolation switch:
    a. Means to lock bypass/isolation switch in the position that isolates transfer switch with an arrangement that permits complete electrical testing of transfer switch while isolated. Interlocks shall prevent transfer-switch operation, except for testing or maintenance, while automatic transfer switch is isolated.
    b. Provide means to make power available to transfer-switch control circuit for testing and maintenance purposes.
    c. Drawout Arrangement for Transfer Switch: Provide physical separation from live parts and accessibility for testing and maintenance operations. Transfer switch and bypass/isolation switch shall be in isolated compartments.
    d. Transition: Provide closed-transition operation when transferring from main transfer switch to bypass/isolation switch on the same power source.
    e. Bypass/Isolation Switch Current, Voltage, Closing, and Short-Circuit Withstand Ratings: Equal to or greater than those of associated automatic transfer switch, and with same phase arrangement and number of poles.
    f. Contact temperatures of bypass/isolation switches shall not exceed those of automatic transfer-switch contacts when they are carrying rated load.

g. Manual Control: Constructed so load bypass and transfer-switch isolation can be performed by one person in no more than two operations in 15 seconds or less. Operating handles shall be externally operated.
h. Legend: Manufacturer's standard legend for control labels and instruction signs shall describe operating instructions.
i. Maintainability: Fabricate to allow convenient removal of major components from front without removing other parts or main power conductors.

4. Interconnection of Bypass/Isolation Switches with Automatic Transfer Switches: Factory-installed copper bus bars; plated at connection points and braced for the indicated available short-circuit current.

B. Remote Annunciator System:
1. Source Limitations: Same manufacturer as transfer switch in which installed.
2. Functional Description: Remote annunciator panel shall annunciate conditions for indicated transfer switches.
3. Annunciation panel display shall include the following indicators:
a. Sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
b. Switch position.
c. Switch in test mode.
d. Failure of communication link.
4. Annunciator Panel: LED-lamp type with audible signal and silencing switch.
a. Indicating Lights: Grouped for each transfer switch monitored.
b. Label each group, indicating transfer switch it monitors, location of switch, and identity of load it serves.
c. Mounting: Flush, modular, steel cabinet unless otherwise indicated.
d. Lamp Test: Push-to-test or lamp-test switch on front panel.

C. Remote Annunciator and Control System:
1. Source Limitations: Same manufacturer as transfer switch in which installed.
2. Include the following functions for indicated transfer switches:
a. Indication of sources available, as defined by actual pickup and dropout settings of transfer-switch controls.
b. Indication of switch position.
c. Indication of switch in test mode.
d. Indication of failure of digital communication link.
e. Key-switch or user-code access to control functions of panel.
f. Control of switch-test initiation.
g. Control of time-delay bypass for transfer to normal source.
3. Malfunction of annunciator, annunciation and control panel, or communication link shall not affect functions of automatic transfer switch. In the event of failure of communication link, automatic transfer switch automatically shall revert to standalone, self-contained operation. Automatic transfer-switch sensing, controlling, or operating function shall not depend on remote panel for proper operation.
4. Remote Annunciation and Control Panel: Solid-state components. Include the following features:
a. Controls and indicating lights grouped together for each transfer switch.

b. Label each indicating light control group. Indicate transfer switch it controls, location of switch, and load it serves.
c. Digital Communication Capability: Matched to that of transfer switches supervised.
d. Mounting: Flush, modular, steel cabinet unless otherwise indicated.

2.5 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

B. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor-Mounting Switch: Anchor to floor by bolting.
1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
3. Provide workspace and clearances required by NFPA 70.

B. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.

C. Identify components according to Section 260553 "Identification for Electrical Systems."

D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

E. Apply circuit breaker trip settings in accordance with recommended settings from Power System Study specified in Section 260573, “Power System Studies.”

F. Comply with NECA 1.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
   1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. After installing equipment, test for compliance with requirements according to NETA ATS.
   2. Visual and Mechanical Inspection:
      a. Compare equipment nameplate data with Drawings and Specifications.
      b. Inspect physical and mechanical condition.
      c. Inspect anchorage, alignment, grounding, and required clearances.
      d. Verify that the unit is clean.
      e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
      f. Verify that manual transfer warnings are attached and visible.
      g. Verify tightness of all control connections.
      h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
         1) Use of low-resistance ohmmeter.
         2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
      i. Perform manual transfer operation.
      j. Verify positive mechanical interlocking between normal and alternate sources.
      k. Perform visual and mechanical inspection of surge arresters.
      l. Inspect control power transformers.
         1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
         2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
         3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.

3. Electrical Tests:
    a. Perform insulation-resistance tests on all control wiring with respect to ground.
    b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
    c. Verify settings and operation of control devices.
    d. Calibrate and set all relays and timers.
    e. Verify phase rotation, phasing, and synchronized operation.
    f. Perform automatic transfer tests.
    g. Verify correct operation and timing of the following functions:
        1) Normal source voltage-sensing and frequency-sensing relays.
        2) Engine start sequence.
        3) Time delay on transfer.
        4) Alternative source voltage-sensing and frequency-sensing relays.
        5) Automatic transfer operation.
        6) Interlocks and limit switch function.
        7) Time delay and retransfer on normal power restoration.
        8) Engine cool-down and shutdown feature.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
    a. Check for electrical continuity of circuits and for short circuits.
    b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
    c. Verify that manual transfer warnings are properly placed.
    d. Perform manual transfer operation.
5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.
    a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
    b. Simulate loss of phase-to-ground voltage for each phase of normal source.
    c. Verify time-delay settings.
    d. Verify pickup and dropout voltages by data readout or inspection of control settings.
    e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
    f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
    g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.
6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.

7. Arc-Energy-Reduction Protection System: For circuit breakers subject to NFPA 70 Article 240.87, performance test the arc-energy-reduction protection system when first installed in accordance with NFPA 70. Perform testing by primary current injection or another approved method. Document the testing and submit test results.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Transfer switches will be considered defective if they do not pass tests and inspections.

F. Remove and replace malfunctioning units and retest as specified above.

G. Prepare test and inspection reports.

H. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
2. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
3. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

SECTION 26 43 13 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Type 1 surge protective devices.
   2. Type 2 surge protective devices.
   3. Enclosures.

B. Related Requirements:
   1. Section 262413 "Switchboards" for integral SPDs installed by switchboard manufacturer.
   2. Section 262416 "Panelboards" for integral SPDs installed by panelboard manufacturer.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include electrical characteristics for SPDs.
   2. NRTL certification of compliance with UL 1449.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.4 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within one (1) year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TYPE 2 SURGE PROTECTIVE DEVICES (SPDs)

A. Standards:
   1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, Type 2.

B. Product Options:
   1. Include LED indicator lights for power and protection status.
   2. Include surge counter.

C. Performance Criteria:
1. Peak Surge Current Rating: Minimum single-pulse surge current withstand rating shall be 100 kA per phase, as published by the SPD manufacturer.
2. Protection Modes and UL 1449 Voltage Protection Ratings (VPR): For grounded-wye, three-phase, four-wire circuits, VPR shall not exceed the following:
a. 480Y/277 V Systems:
1) Line to Neutral: 1200 V.
2) Line to Ground: 1200 V.
3) Neutral to Ground: 1200 V.
4) Line to Line: 2000 V.
b. 208Y/120 V Systems:
1) Line to Neutral: 700 V.
2) Line to Ground: 700 V.
3) Neutral to Ground: 700 V.
4) Line to Line: 1200 V.
3. Protection Modes and UL 1449 Voltage Protection Ratings (VPR): For 240/120-V, single-phase, three-wire circuits, VPR shall not exceed the following:
a. Line to Neutral: 700 V.
b. Line to Ground: 700 V.
c. Neutral to Ground: 700 V.
d. Line to Line: 1200 V.
4. SCCR: 100 kA rms symmetrical minimum.
5. Nominal Discharge Current (In): 20 kA minimum.

2.2 TYPE 3, TYPE 4, AND TYPE 5 SURGE PROTECTIVE DEVICES (SPDs)

A. Type 3, Type 4, and Type 5 SPDs are not approved for field installation.

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's written instructions.

END OF SECTION 26 43 13

SECTION 26 51 19 - LED LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following types of LED luminaires:
   1. Lighting fixtures as indicated on the Luminaire Schedule.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life L70, output (lumens, CCT, and CRI), wattage, and energy-efficiency data.
   6. Warranty information.
   7. Provide lighting calculations for any substituted luminaires.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.5 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within one year warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion for manufacturer's warranty on luminaire replacement or part failure.

PART 2 - PRODUCTS

2.1 GENERAL

A. Luminaires shall be in accordance with the luminaire schedule or approved equal. Any substitution shall equal or exceed criteria and material listed for the base of design luminaire on sheet E-701 “Luminaire Schedule”. Luminaires shall be UL Listed for location in which they are to be installed, Energy star certified, and RoHS Compliant. The naming of the manufacturer or item of material is not intended to be restrictive, but rather to establish criteria for design and quality. Catalog and model numbers are intended to indicate type, quality of design, material, as well as exact operating features required.
   1. Power factor > 0.9
   2. Luminaire’s height above ceiling shall not exceed specified luminaire’s height.
   3. Gauge and material shall equal or exceed basis-of-design luminaire.

2.3 LUMINAIRE REQUIREMENTS

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

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following LED characteristics:
      a. Wattage, lumen output, CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

2.4 MATERIALS

A. Materials shall match specified luminaire materials on luminaire schedule.

B. Metal Parts:
   1. Free of burrs and sharp corners and edges.
   2. Sheet metal components shall be steel unless otherwise indicated.
   3. Form and support to prevent warping and sagging.

C. Steel:
   1. ASTM A 36/A 36M for carbon structural steel.
   2. ASTM A 568/A 568M for sheet steel.

D. Stainless Steel:
   1. Manufacturer's standard grade.
   2. Manufacturer's standard type, ASTM A 240/240 M.

E. Galvanized Steel: ASTM A 653/A 653M.

F. Aluminum: ASTM B 209.

2.5 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Design professional, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Refer to manufacturers installation instructions.

C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

D. Install luminaires as recommended by manufacturers to maintain ratings and warranties.

E. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Flush-Mounted Luminaires:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

G. Wall-Mounted Luminaires:
1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

H. Suspended Luminaires:
1. Ceiling Mount:
a. As noted in luminaire schedule.
2. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
4. Do not use ceiling grid as support for luminaires. Connect support wires or rods to building structure.

J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and

Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 26 51 19

SECTION 27 13 23 - COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. 850 nanometer laser-optimized 50/125 micrometer multimode optical fiber cable (OM4).
   2. Optical fiber cable connecting hardware, patch panels, and cross-connects.
   3. Cabling identification products.

1.2 OPTICAL FIBER BACKBONE CABLING DESCRIPTION

A. Optical fiber backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Reviewed and stamped by RCDD.
   1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   3. Cabling administration drawings and printouts.
   4. Wiring diagrams to show typical wiring schematics including the following:
      a. Telecommunications rooms plans and elevations.
      b. Telecommunications pathways.
      c. Telecommunications system access points.
      d. Telecommunications grounding system
      e. Cross-connects.
      f. Patch panels.
      g. Patch cords.
   5. Cross-connects and patch panels.

C. Optical fiber cable testing plan.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
   1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
   2. Installation Supervision: Installation shall be under the direct supervision of Technician, who shall be present at all times when Work of this Section is performed at Project site.
   3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.
   1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

1.6 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

C. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

D. Grounding: Comply with TIA-607-B.

2.2 850 NANOMETER LASER-OPTIMIZED, 50/125 MICROMETER, MULTIMODE OPTICAL FIBER CABLE (OM4)

A. Description: Multimode, 50/125-micrometer, 8-fiber, nonconductive, tight buffer, optical fiber cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal.
1. Corning Optical Communications
2. Commscope/Systimax
3. Belden
4. Superior Essex
5. Prysmian

C. Standards:
1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with TIA-568-C.3 for performance specifications.
3. Comply with TIA-492AAAD for detailed specifications.

D. Maximum Attenuation: 3.0 dB/km at 850 nm; 1.0 dB/km at 1300 nm.

E. Minimum Overfilled Modal Bandwidth-length Product: 3500 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

F. Minimum Effective Modal Bandwidth-length Product: 4700 MHz-km at 850 nm.

G. Jacket:
1. Jacket Color: Aqua.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-D.
3. Imprinted with manufacturer’s name, fiber count, fiber type, optical-fiber classification (OM4), and aggregate length at regular intervals not to exceed 40 inches.

H. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1651, and NFPA 70 for the following types:
1. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
2. Riser Rated, Nonconductive: Type OFNR or Type OFNP, complying with UL 1666.
3. Riser Rated, Nonconductive: Type OFNP, or Type OFNR in metallic conduit installed per NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

2.3 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal.
1. Corning Optical Communications
2. Commscope/Systimax
3. Belden
4. Panduit

5. Leviton Network Solutions
6. Siemon

B. Standards:
1. Comply with Optical Fiber Connector Intermateability Standard specifications of the TIA-604 series.
2. Comply with TIA-568-C.3.

C. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
1. Number of Connectors per Field: Four LC duplex connectors/adapters for each 8-fiber cable assigned to field, plus spares and blank positions adequate to suit specified expansion criteria. Minimum 25% spare capacity.

D. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths. LC duplex OM4 color Aqua.

E. Connector Type: Type LC complying with TIA-604-10-B duplex connectors.

F. Plugs and Plug Assemblies:
1. Connector Insertion loss not more than 0.25 dB.
2. Color coded and identified in accordance with TIA-598-D.
3. Connectors shall be compatible with specified OM4 multimode optical fiber and LC duplex adapters.
4. Marked to indicate transmission performance.

G. Jacks and Jack Assemblies:
1. LC duplex adapters, compatible with 50/125-micrometer OM4 multimode optical fiber and specified LC connectors.
2. Adapter Insertion loss not more than 0.25 dB.
3. Color coded for identification of multimode optical fiber system.
4. Marked to indicate transmission performance.
5. Designed to snap-in to or otherwise securely mount in specified optical fiber patch panels, enclosures, and or faceplates.
6. Provide zirconia ceramic alignment sleeves.

2.4 GROUNDING

A. Comply with recommended requirements for Grounding and Bonding for Communications Systems for grounding conductors and connectors.

B. Comply with TIA-607-B.

2.5 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.6 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate optical fiber cables.

B. Factory test multimode optical fiber cables in accordance with ANSI/TIA-526-14 and ANSI/TIA-568.3-E.

C. Factory test pre-terminated optical fiber cable assemblies in accordance with ANSI/TIA-526-14 and ANSI/TIA-568.3-E.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
   1. Install plenum cable in environmental air spaces, including plenum ceilings.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

A. Comply with NECA 1, NECA 301, and NECA/BICSI 568.

B. General Requirements for Optical Fiber Cabling Installation:
   1. Comply with TIA-568-C.1 and TIA-568-C.3.
   2. Comply with BICSI ITSIMM, Ch. 6, "Cable Termination Practices."
   3. Terminate all cables; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train cable to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, provide a 10-foot-long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
11. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

C. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Group connecting hardware for cables into separate logical fields.

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI ITSIMM, "Firestopping" Chapter.

3.5 GROUNDING

A. Install grounding according to BICSI ITSIMM, "Grounding (Earthing), Bonding, and Electrical Protection" Chapter and applicable requirements of NFPA 70.

B. Comply with ANSI/TIA-607-E and NECA/BICSI-607.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground in accordance with ANSI/TIA-607-E and NFPA 70.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor in accordance with ANSI/TIA-607-E and NFPA 70.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with ANSI/TIA-606-D.
   1. Administration Class: Class 2.
   2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with ANSI/TIA-606-D for Class 2 level of administration and Owner's telecommunications standards.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
   3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
   4. Label each unit and field within distribution racks and frames.
   5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA-606-D.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA-568.3-E.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Optical Fiber Cable Tests:
    a. Test instruments shall meet or exceed applicable requirements in ANSI/TIA-568.3-E and ANSI/TIA-526-14. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
    b. Test multimode optical fiber links using an optical loss test set (OLTS) with an encircled-flux-compliant launch condition.
    c. Perform end to end attenuation testing of each installed OM4 multimode fiber at 850 nm and 1300 nm.
    d. Perform attenuation measurements using the one-cord reference method in accordance with ANSI/TIA-526-14 and ANSI/TIA-568.3-E.
    e. Record fiber identification wavelength, measured link length, measured attenuation, calculated allowable attenuation, and pass/fail result for each fiber.
    f. Measured attenuation of each optical-fiber link shall not exceed the calculated link-loss budget determined from installed cable length, number of connector pairs, number of splices, and component loss allowances in accordance with ANSI/TIA-568.3-E and the specified component performance requirements.

C. Document test results for each optical-fiber measurement. Submit electronic test reports generated by the test instrument or associated test-management software. Reports shall identify cable and fiber designation, origin and destination, fiber type, test wavelength, measured link length, measured attenuation, allowable attenuation, test direction, test equipment and calibration status, and pass/fail result. Submit native electronic test files and PDF summary reports for 100 percent of installed optical fibers.

D. Remove and replace cabling where test results indicate that it does not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 27 13 23

SECTION 27 15 13 - COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Category 6a twisted pair cable.
   2. Twisted pair cable hardware.
   3. Cable management system.
   4. Identification products.

1.2 DEFINITIONS

A. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

B. EMI: Electromagnetic interference.

C. FTP: Shielded twisted pair.

D. F/FTP: Overall foil screened cable with foil screened twisted pair.

E. F/UTP: Overall foil screened cable with unscreened twisted pair.

F. IDC: Insulation displacement connector.

G. Jack: Also commonly called an "outlet," it is the fixed, female connector.

H. LAN: Local area network.

I. Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

J. RCDD: Registered Communications Distribution Designer.

K. Screen: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

L. Shield: A metallic layer, either a foil or braid, placed around a pair or group of conductors.

M. S/FTP: Overall braid screened cable with foil screened twisted pair.

N. S/UTP: Overall braid screened cable with unscreened twisted pairs.

O. UTP: Unscreened (unshielded) twisted pair.

1.3 COPPER HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable cabling system shall provide interconnections between Distributor A, Distributor B, or Distributor C, and the equipment outlet, otherwise known as "Cabling Subsystem 1," in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.
   1. TIA-568-C.1 requires that a minimum of two equipment outlets be installed for each work area.
   2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
   3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. A work area is approximately 100 sq. ft. and includes the components that extend from the equipment outlets to the station equipment.

C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Reviewed and stamped by RCDD.
   1. System Labeling Schedules:
      a. Electronic copy of labeling schedules, in software and format selected by Owner.
      b. Electronic copy of labeling schedules that are part of cabling and asset identification system of software.
   2. Cabling administration Drawings and printouts.
   3. Wiring diagrams and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:
      a. Telecommunications rooms plans and elevations.
      b. Telecommunications pathways.
      c. Telecommunications system access points.
      d. Telecommunications grounding system.
      e. Telecommunications conductor drop locations.
      f. Typical telecommunications details.
      g. Proximity and reference to mechanical, electrical, and plumbing systems.

C. Twisted pair cable testing plan.

D. Samples: For telecommunications jacks and plugs, in specified finish, one for each type and configuration and cover plates for color selection and evaluation of technical features.

E. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Cover Plates: Ten of each type.
2. Jacks: Ten of each type.
3. Patch-Panel Units: One of each type.
4. Plugs: Ten of each type.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings, cabling administration Drawings, and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

B. Testing Agency Qualifications: Testing agency must have personnel certified by BICSI on staff.
1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.
1. Test each pair of twisted pair cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA-568-C.1, when tested according to test procedures of this standard.

B. Telecommunications Pathways and Spaces: Comply with TIA-569-D.

C. Grounding: Comply with TIA-607-B.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard and NFPA 70 for the following types:
   1. Communications, Plenum Rated:
      a. Type CMP complying with UL 1685.
      b. Type CM, Type CMG, Type CMP, Type CMR, or Type CMX in metallic conduit installed according to NFPA 70, Article 300.22, "Wiring in Ducts, Plenums, and Other Air-Handling Spaces."

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 IDENTIFICATION PRODUCTS

A. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.4 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test cables on reels according to TIA-568-C.1.

C. Factory test twisted pair cables according to TIA-568-C.2.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

2.5 CATEGORY 6a TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz. Comply with ANSI/TIA-568.2-E Category 6A performance requirements.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal.

1. Belden
2. Commscope/Systimax
3. Siemon – Z-Max
4. Leviton Network Solutions – Atlas X1

C. Standard: Comply with TIA-568-C.2 for Category 6a cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP)

F. Cable Rating: Plenum.

G. Jacket: Blue thermoplastic.

2.6 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal.

1. Belden - REVConnect
2. Commscope/Systimax
3. Siemon – Z-Max
4. Leviton Network Solutions – Atlas X1

C. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of Category 6a.
2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

D. Source Limitations: Obtain twisted pair cable hardware from single source from single manufacturer.

E. Connecting Blocks:

1. 110-style IDC for Category 6a.
2. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.

G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:

a. Universal T568A and T568B wiring labels.
b. Labeling areas adjacent to conductors.
c. Replaceable connectors.
d. 24 ports.

2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

H. Patch Cords: Factory-made, four-pair cables in 36-inch lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.

I. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Standard: Comply with TIA-568-C.2.
3. Marked to indicate transmission performance.

J. Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568-C.2.
4. Marked to indicate transmission performance.

K. Faceplate:

1. Three Cat. 6A plenum rated cables terminated on Cat. 6A jacks in a single gang quad jack faceplate with a single blank. Installed at industry standard height. A coil of cable will be

left accessible at far end of each cable run accessible above drop ceiling, if available. Two cables, for County use, will have white Cat. 6A jacks. One cable will have a blue Cat. 6A jack for vendor use.

2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
3. For use with snap-in jacks accommodating any combination of twisted pair work area cords.

    a. Flush mounting jacks, positioning the cord at a 45-degree angle.

L. Wireless Access Point (WAP) data drops will be defined as: a single Cat. 6A plenum rated cable terminated in a Cat. 6A jack, accessible above the drop ceiling of the designated location or in conduit with double gang box mounted to a solid ceiling. Terminated on a designated WAP patch panel, the size TBD.

M. Legend:

1. Snap-in, clear-label covers and machine-printed paper inserts.

2.7 CABLE MANAGEMENT SYSTEM

A. Description: Computer-based cable management system, with integrated database and graphic capabilities.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal.

1. Chatsworth Products (CPI)
2. Panduit
3. Siemon
4. Commscope/Systimax
5. Legrand/Ortronics
6. Leviton Network Solutions
7. Hubbell Premise Wiring

C. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.

D. Information shall be presented in database view, schematic plans, or technical drawings.

1. AutoCAD drawing software shall be used as drawing and schematic plans software.

E. System shall interface with the following testing and recording devices:

1. Direct upload tests from circuit testing instrument into the personal computer.
2. Direct download circuit labeling into labeling printer.

2.8 GROUNDING

A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.

B. Comply with TIA-607-B.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Comply with accepted code requirements and recommended practices for demarcation point, cabinets, and racks.

B. Comply with Section 260529 "Hangers and Supports for Electrical Systems."

3.2 INSTALLATION OF TWISTED PAIR HORIZONTAL CABLES

A. Comply with NECA 1 and NECA/BICSI 568.

B. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, attics, and gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes.
3. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
4. Surface mounted boxes on existing walls shall have RGS conduit to above ceiling. Conduit shall be seal with pick resistant sealant.
5. Recessed boxes shall be installed in new walls with recessed raceway.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

D. General Requirements for Cabling:
1. Comply with TIA-568-C.1.
2. Comply with BICSI's "Information Transport Systems Installation Methods Manual (ITSIMM), Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section.
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.

5. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. MUTOA shall not be used as a cross-connect point.
7. Consolidation points may be used only for making a direct connection to equipment outlets:
    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted pair cables at least 49 feet from communications equipment room.
8. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
9. Install lacing bars to restrain cables, prevent straining connections, and prevent bending cables to smaller radii than minimums recommended by manufacturer.
10. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Cable Termination Practices" Section. Use lacing bars and distribution spools.
11. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
12. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
13. In the communications equipment room, install a 10-foot long service loop on each end of cable.
14. Pulling Cable: Comply with BICSI Information Transport Systems Installation Methods Manual, Ch. 5, "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.

E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend twisted pair cabling, not in a wireway or pathway, a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:
1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569-D for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with "Firestopping Systems" Article in BISCI's "Telecommunications Distribution Methods Manual."

3.4 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Install grounding according to the "Grounding, Bonding, and Electrical Protection" chapter in BICSI's "Telecommunications Distribution Methods Manual."

C. Comply with TIA-607-B and NECA/BICSI-607.

D. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall, allowing at least a 2-inch clearance behind the grounding bus bar. Connect grounding bus bar to suitable electrical building ground, using a minimum No. 4 AWG grounding electrode conductor.

E. Bond metallic equipment to the grounding bus bar, using not smaller than a No. 6 AWG equipment grounding conductor.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with

requirements for identification specified in Section 260553 "Identification for Electrical Systems" and Owner's standards.

1. Administration Class: Class 3.
2. Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

B. Paint and label colors for equipment identification shall comply with TIA-606-B for Class 3 level of administration.

C. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

E. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if wire color is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip, and screw terminal in each cabinet, rack, or panel.

    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group, extended from a panel or cabinet to a building-mounted device, with the name and number of a particular device.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and -connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

F. Labels shall be preprinted or computer-printed type, with a printing area and font color that contrast with cable jacket color but still comply with TIA-606-B requirements for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.6 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:
   1. Notify Onwer and Architect a minimum of five business days before performing acceptance testing.
   2. Verify that telecommunications cabling, connecting hardware, equipment, labeling, grounding and bonding, and associated work are completely installed before testing.
   3. Verify that test equipment is calibrated in accordance with the equipment manufacturer's requirements and has a current calibration certificate.
   4. Provide qualified personnel trained in the operation of the specified test equipment and in testing the installed telecommunications cabling system.
   5. Perform testing after permanent terminations are complete and before the telecommunications system is placed into service.

B. Tests and Inspections:
   1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA-568-C.1.
   2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
   3. Test twisted pair cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
      a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, saved as text files, printed, and submitted.

D. Nonconforming Work:
   1. End-to-end cabling will be considered defective if it does not pass tests and inspections.
   2. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. Collect, assemble, and submit test and inspection reports.

F. Manufacturer Services:
   1. Engage factory-authorized service representative to support field tests and inspections.

PART 4 - YDC DATA CABLING INFRASTRUCTURE

4.1 COUNTY DATA WIRING

A. All County data cabling and connectors must be installed in accordance with good engineering practices as approved by the TIA/EIA, NEC and in accordance with all local building codes.

B. All data wiring used will be Plenum rated Cat6A and terminated in Cat6A connectors in single gang, Quad faceplates unless otherwise designated.

C. Patch Panels will be Cat6A rated and meet industry standards. Labeled to correspond with wall jacks.

D. Each cable will have a permanent unique identification at each end that corresponds with the patch panel and faceplate label.

E. All cabling must be properly terminated at each end, tested and ready for use. Test results will be turned over the County of Berks IT department at completion of the project. Data drop patch panel labeling will be 01 – 48, where multiple patch panels are located in the same data room the panel will have a Letter designation at the end of the port. Top patch panel will be 01A through 48A, the second patch panel will be labeled as 01B though 48B. If a third patch panel is needed it will be 01C through 48C. The patch panels will be grouped by use, the type of use lettering is defined as:
   1. A = Analog / W = WAP / D = County date / V = Vendor use for Medical and School District / S = Security
   2. I = IDF room / S = Server room / LI = Lower IDF (new data room)

4.2 CABLE DESIGNATION LABELING:

A. Each cable will be labeled with the following information in this order.

B. Data room, type of use, port number, patch panel letter. Examples.

C. ID09C = IDF, Data port 9 on county patch panel C

D. IV36B = IDF, Vender port 36 on vendor patch panel B.

E. SD44A = Server room, Data port 44 on county patch panel A.

F. LIW12A = Lower IDF, WAP port 12 on WAP patch panel A.

G. The County would like to update All Existing data wiring locations. New data drop locations, will share the same definition as Data Drops, unless otherwise noted.

4.3 DATA DROPS

A. Data drops will be defined as:
   1. 3 Cat6A plenum rated cables terminated on Cat6A jacks in a single gang Quad jack faceplate with a single blank. Installed at industry standard height. A coil of cable will be left accessible at far end of each cable run accessible above drop ceiling, if available. 2 cables, for county use, will have white jacks. 1 cable will have a blue cat6A jack for vendor use.

4.4 WIRELESS ACCESS POINT (WAP) DATA DROPS

A. Wireless Access Point (WAP) Data Drops will be defined as:
   1. a single Cat6A plenum rated cable terminated in a Cat6A jack, accessible above the drop ceiling of the designated location or in conduit with double gang box mounted to a solid ceiling. Terminated on a designated WAP patch panel, the size TBD.

4.5 VIDEO COURT LOCATIONS

A. The video court locations will have the electric outlet and the data drop installed at a height so that it will be inside the secure enclosure used to house the video court equipment.

4.6 PHONE WALL DROPS

A. Phone Wall Drops will be defined as:
   1. a single Cat6A plenum rated cable left unterminated at ADA height for wall mounted phones covered with a blank plate. The cable shall be coiled inside the box behind the plate.

4.7 RACK EQUIPMENT INSTALLATION ORDER

A. The Data racks will be in the following order from top to Bottom.
   1. Fiber panels
   2. Analog patch panel A (24 port)
   3. WAP patch panel A (24 port)
   4. County data patch panel A
   5. Cable management
   6. County Switch stack -1
   7. County data patch panel B
   8. Cable management
   9. County switch stack – 2
   10. County data patch panel C
   11. Cable management
   12. County switch stack – 3
   13. Cable management
   14. County data patch panel D
   15. Cable management
   16. County switch stack - 4
   17. Vendor patch panel A

18. Cable management
19. Vendor Patch panel B

4.8 LOWER IDF RM B115A (NEW ROOM) ANALOG EXTENSION TO THE IDF RM A123

A. Six (6) Cat6A wires will be run between the IDF RM A123 AND IDF B115A Data rooms. Terminated on a 24 port Cat6A patch panel in the IDF RM A123 and on a 24 port Cat6A patch panel in the IDF RM B115A. Patch Panel will be Cat6A rated and meet industry standards. Terminated at each end, tested and ready for use. The IDF patch panel will be labeled “To Analog Lower IDF” and the ports to be numbered B-1 through B-24. The Lower IDF patch panel will be labeled “To Analog IDF” and the ports to be numbered B-1 through B-24.

4.9 UPPER IDF (NEW ROOM) ANALOG EXTENSION TO THE IDF

A. Six (6) Cat6A wires will be run between the IDF RM A123 AND IDF A237A Data rooms. Terminated on a 24 port Cat6A patch panel in the IDF RM A123 and on a 24 port Cat6A patch panel in the IDF RM A237A. Patch Panel will be Cat6A rated and meet industry standards. Terminated at each end, tested and ready for use. The IDF patch panel will be labeled “To Analog Upper IDF” and the ports to be numbered B-1 through B-24. The Lower IDF patch panel will be labeled “To Analog IDF” and the ports to be numbered B-1 through B-24.

4.9 FIBER EXTENSION FROM THE LOWER IDF RM B115A TO IDF RM A123

A. Run new Fiber from the Lower IDF RM B115A to IDF RM A123 data room. Provide a fiber patch panel with LC connectors at each end, rack mounted, terminated and tested. Test results will be turned over the County of Berks IT department at completion of the project. The fiber to be installed will be four (4) pairs of 850 nm laser-optimized, 50/125 um, OM4 multimode fiber optic cable.

4.10 FIBER EXTENSION FROM THE UPPER IDF RM A237A TO THE IDF RM A123

A. Run new Fiber from the IDF RM A237A to the IDF RM A123 data room. Provide a fiber patch panel with LC connectors at each end, rack mounted, terminated and tested. Test results will be turned over the County of Berks IT department at completion of the project. The fiber to be installed will be four (4) pairs of 850 nm laser-optimized, 50/125 um, OM4 multimode fiber optic cable.

4.11 SECURITY WIRING NEEDS

A. The Security needs will be designed by the low voltage engineer. The County of Berks IT department will be providing network switches. All Security data wiring will be in a different color than the color of the County data network cabling and terminated in separate data racks.

4.12 SECURITY SUPPORT DOCUMENTATION

A. Security vendor will supply a spreadsheet, both hardcopy & electronically, documenting any relevant information relating to the Security control system. The spreadsheet will have a tab for each device, Network Switches, Cameras, Door controlling equipment, intercoms, any related security devices that may be added to the scope. Each tab will contain any information that would be needed for setting up and troubleshooting of that device.

B. For example: Camera Tab.

C. Camera number, name, camara model, port on patch panel it is plugged into and the switch port it is plugged into and the location of the data room.

Number	Name	Model	patch panel port	Switch Name	Switch port	Data room
85	Intake Door IN	ABC - 123 VW	SS36B	nberks-swxxx	47-1	Server room
86	Intake Door OUT	ABC - 123 V	SS37B	nberks-swxxx	47-2	Server room

END OF SECTION 27 15 13

SECTION 28 05 00 – COMMON WORK RESULTS FOR SECURITY SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 and the following Specifications apply to work of this Section- SECURITY AND COMMUNICATION SYSTEMS SPECIFICATIONS- GENERAL REQUIREMENTS.

1. Division 1: General Conditions- Refer to all contract drawings and specifications listed in this Section 28 05 00 for additional requirements.
2. Construction Specification Sections:

Section 28 05 00	Common Work Results for Security Systems
Section 28 05 10	Security Systems- Special Requirements
Section 28 05 20	Control Consoles, Cabinets, and Enclosures
Section 28 05 30	Operational Sequences for Security Systems
Section 28 06 10	Security Network Equipment
Section 28 13 00	Access Control
Section 28 23 00	Video Surveillance System
Section 28 50 00	Intercom and Paging System
Section 28 70 00	Watch Tour

3. Contract Drawings:

   ES Series Drawings shall be considered the Contract Drawings as referenced in the above noted Specification Sections. Refer to sheet A-000 for full list of ES sheets.

1.2 CODES, STANDARDS AND REGULATIONS

A. All work of Division 28, and the works of the related sections shall comply with the latest codes, standards and regulations of the following:

1. National Electric Code (NEC) – NFPA 70.
2. National Fire Protection Association (NFPA).
3. International Building Code (IBC) NJ Edition.
4. Underwriters' Laboratories (UL).
5. National Electrical Manufacturers Association (NEMA).
6. Instrument Society of America (ISA).
7. Institute of Electrical & Electronic Engineers (IEEE).
8. Federal, State, and Local Ordinances.
9. Federal Communications Commission (FCC) Regulations.
10. Americans with Disabilities Act (ADA).
11. Telecommunication Industries Association (TIA).
12. Electronic Industries Association (EIA)

1.3 SUMMARY OF PROVISIONS IN THIS SECTION

A. This Section includes:
1. Requirements regarding qualifications of the contractor and all sub-contractors.
2. Qualification requirements for all technical personnel of the said contractor and subcontractors assigned to this project.
3. Submittals related to overall system of security and detection equipment proposed by the General Contractor.
4. Coordination of the Security Systems work with the works of other trades.
5. Testing of the installed security and detection equipment.

1.4 DESCRIPTION OF WORK – BASE BID SUMMARY

A. All work described in Division 28, except for Sections dedicated to Fire Alarm, shall be performed by or through joint execution between the General Contractor under this contract, and all their subcontractors, and the Security System Contractor, who is contracted directly with the County of Berks.

B. The following is a generalized description of the responsibilities of each contractor. Further details are provided in part 1.10 Responsibility Matrix under these specifications. The Contractor shall refer to all Contract Drawings and Specifications for a complete definition of work required. The following is only a generalized summary of work required.
1. General Contractor:
a. Provide all Electrical work including Special Backboxes and specialized junction boxes that are to be installed by the electrical contractor. Provide all security equipment receptacles, power distribution strips, and connections.

b. Provide all conduit, cable tray, J-Hooks, ladder racks, and all other required cable infrastructure for the Security systems cabling.

c. Provide Security Fasteners for installation of all devices. Provide tamper-proof fasteners in all areas exposed to the detainees.

2. Berks County Security System Contractor:
a. Provide Conductors and Cables required for systems specified in Division 28 installed in conduits, raceways and infrastructure provided by the General Contractor. Coordinate with General Contractor and Electrical Contractor where applicable. Refer to the Contract Drawings and Division 26 for additional requirements.

b. Provide Security Fasteners for installation of all devices. Provide tamper-proof fasteners in all areas exposed to the detainees.

c. Provide control workstations at the Central Control stations for normal and emergency control of gates and doors in the path of egress/access, video surveillance monitoring and recording, intercom, paging, and duress; coordinate with Owner.

d. Provide server-grade computer system with Touchscreen Graphical User Interface, software, printers, communication devices and peripheral devices for control, monitoring, logging, printing, and archiving of all Security/Communication Systems and all necessary system and application programs, specified in Division 28 and outlined on the Contract Drawings.

e. Provide Access Control System (ACS) integrating all sub-systems including Door/Gate Control. Provide distinctive sound signals for each system. Provide interfacing with all electric doors, hardware, card readers, VSS, Intercom Paging system, Duress Alarm, and touchscreen computer Graphical User Interface (GUI) screens.

f. Provide all door monitoring switches outlined on Contract Drawings. Wire and integrate all electric door locks and Door Position switches that are integral to the security doors. Provide all power supplies, relays, and interfaces to the Touchscreen Control System.

g. Provide Intercom and Paging System. Provide Master Intercom Station at Central Control and local control rooms as indicated. Provide paging speakers with adapter transformers and cabling throughout the entire facility. Provide intercom stations at all locations identified in the Contract Drawings. Provide cabling as required. Provide amplifiers and paging adapters. Provide equipment racks. Provide integration with the control system's touchscreen GUI screens.

h. Provide IP-based Video Surveillance System including cameras with, exterior weatherproof housings and heaters, lenses, monitors, network recorders, video management server and software, fiber optic transceivers for all exterior cameras, patch panels, equipment racks, patch cables and miscellaneous mounting hardware.

i. Provide all Access Control card readers, housings, adapters, cabling, backboxes, and interfaces to the Touchscreen Control System. Provide all necessary Access control database management software, reporting software and card generation and record management software. Provide guard tour function as described in specifications.

j. Provide Wired Duress buttons as outlined in the contract documentation.

k. Provide Watch Tour System.

l. Provide two (2) year on-site service warranty for all parts and labor. Provide Spare Parts/Service Contract – for equipment intended to be used after expiration of the warranty.

m. Provide training on all equipment and all training materials.

n. Provide single point grounding of all Security and Communication Systems Components and circuits provided under this Contract.

o. Install network switches provided and configured by County of Berks IT. The contractor shall inform County IT of specific data port and configuration requirements.

p. Coordinate all work with other contractors as necessary, including door installer, electrical and fire protection contractors, to ensure a fully integrated functioning Security Control and Communications System.

1.5 SPECIAL SYSTEMS CONTRACTOR (SSC) QUALIFICATION REQUIREMENTS

A. Any Special Systems Contractor (SSC) shall submit qualification data for approval as part of the submittal process. Verbal approval will not satisfy this requirement. All SSC's shall submit a completed AIA 305 form and all information exactly as required. Grounds for disqualification shall exist if it is proven that the information submitted is inaccurate or, in the opinion of the Design Professional and Owner, does not satisfy the qualification requirements. If the submitted SSC is disqualified, the General Contractor shall submit an SSC firm meeting stated qualifications at no additional cost to the Owner.

B. The SSC, all sub-contractors and their technical personnel, performing SSC work shall have a minimum of five (5) years of proven experience in the installation and servicing of systems of similar size, complexity, and performance. The proven, relevant experience requirement shall apply to all personnel providing Systems work on this project. Relevant experience shall be defined as systems with similar complexity and integration requirements as the work required under this Contract. The Contractor shall submit system description, detail, and other information to demonstrate that they are qualified for this project. Submit qualification data, list of key personnel assigned to this project and references as specified in this section. The Design Professional and Owner shall have the opportunity to contact all contractor references and visit any of the referenced projects through arrangements and coordination provided by this contractor at no additional cost.

C. The SSC shall submit the following qualification data:

1. Evidence that the organization and technical personnel assigned to this project have a minimum of 10 years experience in successfully completing projects of equal scope, quality, type, and complexity to that required herein. Include resume(s) of personnel providing work for this project, with description of responsibilities on this project and referenced projects.

2. List of at least three (3) comparable correctional/detention projects, completed within the last 10 years, on which min. 80% of Security Surveillance Systems work has been

performed directly by the SSC technical personnel that have been operational for a min. of three (3) years. Include for each facility the following:

a. Name and location of Project.
b. Name, address, and telephone number of the Design Professional.
c. Name, address, and telephone number of the Owner.
d. Name, address, and telephone number of General Contractor and Project Manager.
e. Name, address, and telephone number of SSC's Bonding Company for the individual project.
f. Date of Occupancy.
g. Contract Values: Entire Project and SSC's portion.
h. Type and size of systems provided.

3. The Contractors shall provide all detailed information requested during review and qualification process promptly to allow complete evaluation of contractor's qualifications, quality of work and warranty services provided for the referenced projects.
4. The Contractors shall be responsible for site visits to referenced projects.

D. All SSC's shall be qualified and be responsible for directly performing the Security and Control Systems work, shown on contract documents.

E. The SCC's installers shall have manufacturer's training on all systems being provided. If required, The Contractor shall provide on-site assistance of manufacturer's representative to aid in any installation or troubleshooting problems.

F. All equipment and materials provided shall be new and without blemish or defect. All equipment shall bear labels attesting to Underwriters Laboratories listing where subject to Underwriters Laboratories label service (UL file numbers shall be available for all UL listed products upon request to substantiate the listing). All manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of five (5) years unless stated otherwise in these specifications.

G. Each major component of equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code Ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance.

1.6 PERSONNEL REQUIREMENTS

A. The following personnel shall be assigned to the project with resumes submitted with technical proposal:
1. Principal-in-Charge with QA/QC responsibility.
2. Project Manager with QA/QC responsibility.

3. Project Engineer with Network Certification, 5 years experience and Design responsibility with formal Electronics training and Operations knowledge and/or Certified Electronic Technician (CET) with Network Certification and 5 years experience.
4. Field Technician with 5 years experience and certifications in the installed products.
5. Programmer(s) with certifications for all software and manufacturers the Contractor will be provided for the project.

B. Network certifications shall consist of MCSE, CCNP, and/or TIA certification as a minimum.

1.7 RELATED WORK

A. Related work includes, but is not limited to, the following:
1. Miscellaneous steel and hangers required for the support of electrical equipment.
2. Equipment identification as specified herein and elsewhere.
3. Assembly of equipment furnished disassembled.
4. Cleaning of all apparatus specified elsewhere.

B. Where the SSC is required to install items furnished by the Owner, they shall include for such items:
1. The coordination of their delivery.
2. Their safe handling and field storage to the time of final acceptance in the project.
3. The correction of any damage, defacement, or corrosion to which they may have been subjected.
4. Their field assembly and internal connection as may be necessary for their proper operation.
5. Their mounting in place including the purchase and installation of all dunnage, supporting members, and fastening necessary to adapt them to architectural and structural conditions.
6. Their connection to systems specified, including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

1.8 DEFINITIONS AND APPLICABILITY TO DIVISION 28 SECURITY AND COMMUNICATION SYSTEMS WORK

A. The definitions of this section are intended to preserve and expand the applicability of definitions of the General Conditions for all Contract Documents. These definitions are intended to add requirements applicable to Division 28 Special Systems Work. Refer to Division 28, Security and Communication System Specifications and Contract Drawings for additional requirements.

B. The following additional definitions shall apply to all Special Systems work:
1. “PROVIDE” shall mean that this contractor shall furnish, install, test, adjust, start-up, program, interface and service all devices required for complete and operational Security Systems.

2. "INTEGRATION" shall mean that this Contractor shall provide all systems interfacing and programming necessary to physically and logically connect multiple systems through hardware, software and project specific programming.
3. "PROVIDE CABLING" shall mean that this Contractor shall provide cabling, raceways, concrete encased conduits, and rigid or EMT conduits as specified for each type of location. Comply with requirements of Division 26 for acceptable conduit types.
4. "RESPONSIBILITY OF THIS CONTRACTOR" shall mean the work shall be performed by the SSC subcontractor under the overall direction and supervision of the Prime Contractor having a contract directly with the Agency.
5. "New" shall mean unused and currently manufactured within one (1) year.

1.9 INTERPRETATION OF CONTRACT DOCUMENTS

A. This section of the specifications and related drawings describe general provisions applicable to every section of Division 28.

B. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenance or accessories necessary to complete any required system or item of equipment are to be omitted. The Architect & Design Professional's interpretation of Contract Documents for minimum performance requirements shall be binding to the Contracts.

C. The drawings utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed, in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural contract drawings and on equipment shop drawings. No interpretation shall be made from the limitation of symbols and diagrams that any elements necessary for complete work are excluded.

D. Certain details appear on the drawings that are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

E. Information as to the general arrangement of construction shall be derived from architectural and structural drawings and specifications only.

F. The use of words in the singular shall not be considered as limited where other indications denote that more than one item is referred to.

G. The drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions of detail drawings. For exact locations of building elements, refer to dimensioned drawings; however, field measurements take precedence over dimensioned drawings. Report to the Architect & Design Professional any discrepancies discovered between security drawings and the drawings for other divisions of work.

H. The Contract Division and Specifications are complementary; what is shown and required on one document shall be provided as if shown and required by all documents.

I. Provide all materials for systems, resulting upon completion, in functioning systems in compliance with performance requirements specified. The omission of express reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as a release from furnishing such parts.

J. Any deviations from the wiring shown due to a particular manufacturer's requirements shall be made at no additional cost to the Owner. Changes in electrical service to equipment due to substitutions of equipment by any contractors shall be at the cost of that contractor.

1.10 RESPONSIBILITY MATRIX

A. The Responsibility Matrix indicates the minimum required responsibility of all referenced parties. Lack of a specifically noted responsibility on the matrix shall not relieve the Contractors from the responsibility to provide complete and fully functional infrastructure. In cases where there are multiple parties responsible for a particular item, it shall be the responsibility of the Contractor to coordinate all efforts.

B. Entity Legend:

1. OWNER – The Owner, County of Berks.
2. TWG – The County’s Security Systems Contractor hired directly by the County outside of this contract.
3. GC – General Contractor and their subcontractors.
4. EC – Electrical Contractor and their subcontractors.

C. Abbreviations:

1. VSS – Video Surveillance System
2. ACS – Access Control System
3. DHW – Door Hardware
4. DDHW – Detention Door Hardware
5. Coord.- Coordination

See Responsibility Matrix on the following page.

Item	Furnish	Install	Configure
Security Systems Network Cabling. Including, but not limited to, Cat-6 distribution cable, CAT-6 Patch Cabling, Fiber Optic Backbone Cabling, and Fiber Optic Patch Cables	EC	EC	EC
Security Systems Cable Tray, Conduit, J-Hooks, all Other Pathways, and Backboxes	EC	EC	EC
Security Systems Equipment Racks and All Rack Accessories	TWG	TWG	TWG
Security Systems Equipment Enclosures and All Accessories	TWG	TWG	TWG
Security Systems Patch Panels, Rack Shelves, Mounting Accessories, and Rack Wire Management	TWG	TWG	TWG
Security Uninterruptible Power Supplies (UPS's)	OWNER	EC	EC
Emergency Generator Backed Power for Security Equipment	EC	EC	EC
Vertical and Horizontal Power Distribution in Security System Equipment Racks	TWG	TWG	TWG
Security Systems Network Switches	OWNER	OWNER	OWNER (coord. w/ TWG)
Furniture and Millwork in Security Control Rooms	GC	GC	GC
ACS Equipment: Card Readers, Reader Interfaces, ACS Panels, Gateways, Access Control Computer, Door Position Switches, REX PIR, Pushbuttons, Duress Buttons, and Accessories	TWG	TWG	TWG
ACS Software, Programming, and Licensing	TWG	TWG	TWG
ACS Credentials	TWG	TWG	TWG (coord. w/ OWNER)
ACS Cabling and Cable Connectors	EC	EC	EC
ACS Cable Infrastructure, Pathways, and Backboxes	EC	EC	EC
New Commercial (non-detention) Electrified Door Hardware for ACS	TWG	TWG	TWG

Item	Furnish	Install	Configure
New Detention Electrified Door Hardware	TWG	TWG	TWG
All Other Door Hardware	GC	GC	GC
Lock Cylinders and Keying	GC	GC	GC
Doors, Frames, and door/frame prep for Electrified Hardware	GC	GC	GC
Electronically Operated Vehicle Gate Replacement	GC	GC	GC
Security Electronic Hardware for Exterior Pedestrian Gates	TWG	TWG	TWG
VSS Equipment: Cameras, Mounts, Monitors, Workstations, Servers, NVRs, and Accessories	TWG	TWG	TWG
VSS Software, Programming, Integration, and Licensing	TWG	TWG	TWG
VSS Cabling and Cable Connectors	EC	EC	EC
VSS Cable Infrastructure, Pathways and Backboxes	EC	EC	EC
VSS Exterior Camera Poles	EC	EC	EC
Intercom and Paging System Equipment: Servers, Computers, Exchanges, Amplifiers, Main Stations, Substations, Paging Speakers, and Accessories	TWG	TWG	TWG
Intercom and Paging System Software, Programming, Integration, and Licensing	TWG	TWG	TWG
Intercom and Paging System Cabling and Connectors	TWG	TWG	TWG
Intercom and Paging System Cable Infrastructure, Pathways, and Backboxes	EC	EC	EC
Watch Tour System Equipment: Check Points, Wand, Docking Station, Power Supply, and Accessories	TWG	TWG	TWG
Watch Tour System Software and Setup	TWG	TWG	TWG
Watch Tour Cabling and Connectors	EC	EC	EC
Watch Tour Cable Infrastructure, Pathways, and Backboxes	EC	EC	EC

PART 2 PRODUCTS

2.1 SUBSTITUTIONS

A. When the SSC substitutes equipment manufactured by a vendor other than the specified manufacturer, the Contractor shall be responsible for the operation of the product in the intended system, including all related costs required to make the design work, function, and fit in the allocated space. The Contractor shall submit all substitutions to the Owner and the Design Professional for approval within 15 days from Notice-To-Proceed (NTP). The Owner retains the right to refuse any substitutions.

B. Refer to Division 1 and 28 for Product Options and Substitutions.

C. All substitutions shall meet the performance requirements specified at a lower cost to the Owner than the products specified.

D. The SSC shall submit all data necessary to prove that the substitute products meet the performance requirements shown on the Contract Documents.

E. The SSC shall submit all requests for substitutions to identify the following:
   1. Specification section, paragraph, model, and manufacturer of the product specified.
   2. Suggested substitute including model and manufacturer and each component required, including quantities.
   3. Credit to the Owner.
   4. Complete product data, including cut sheets, manufacturer specifications, application diagrams, and installation details.
   5. Description of the reason why, in the SSC's opinion, substitution is recommended. Description and details for installation of the substitute product as specifically required for this project.
   6. Technical description of equivalent performance and any deficiencies.

2.2 MANUFACTURED PRODUCTS

A. Materials and equipment provided shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

B. When more than one unit of the same type of equipment or material is required, such units shall be the products of a single manufacturer.

C. Equipment Assemblies and Components
   1. All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to the Design Professional and Contracting Officer.
   2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
   3. Components shall be compatible with each other and with the total assembly for the intended service.

4. Constituent parts which are similar shall be the product of a single manufacturer.
5. Moving parts of any element of equipment of the unit normally requiring lubrication, shall have means provided for such lubrication, and shall be adequately lubricated at the factory prior to delivery.

D. All factory and field wiring shall be identified on the equipment being furnished and on all wiring diagrams.

2.3 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the National Electrical Code, install an identification sign which will clearly indicate information required for use and maintenance of items such as cabinets, control devices and other significant equipment except in areas directly accessible to inmates.

B. Nameplates shall be laminated white phenolic resin with a black core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions. Affix with rivets or other approved fasteners. Glue, tape, or cement is not approved.

C. Upper case letters of uniform height; centered on device, coverplate, or enclosure; engraved letters filled with a contrasting color; and all characters made clearly and distinctly.

D. Use abbreviations defined in the contract documents whenever possible. Use plan designations for labeling unless indicated otherwise.

E. Refer to Section 28 05 10 for cable labeling requirements.

PART 3 EXECUTION

3.1 INSPECTION AND PREPARATION OF WORK

A. Prior to any work, the SSC shall carefully inspect the installed work of all other trades and verify that all such work is complete to the point where his installation may properly commence.

B. Verify and certify to the Architect & Design Professional/Owner that all equipment may be installed in accordance with all pertinent codes and regulations, the contract drawings and specifications and the referenced standards.

C. Return to original condition any paved areas, sidewalks, planting, etc., disturbed during system installation.

3.2 INSTALLATION

A. Install all equipment in accordance with the manufacturer's recommendation.

B. Secure equipment-using fasteners suitable for the use, materials, and loads encountered. All hardware shall be tamperproof. Submit evidence-providing suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.

C. Equipment location shall be as close as possible to locations shown on contract drawings. Coordinate locations of devices with other trades. The SSC shall provide wall, console, furniture, millwork mounted or ceiling mounted devices as directed by the Architect & Design Professional with no additional cost to the Owner.

D. Working spaces shall be at minimum as specified in the National Electrical Code for all voltage specified, but not less than 3 feet.

E. All equipment shall be installed in location and manner that will allow for convenient access for maintenance and inspection.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

G. Routing shall be laid out in advance. The SSC Contractor shall develop detailed coordination drawings to identify use of chases, spaces above ceiling and Mechanical / Electrical / Security / Electronic Rooms. The General Contractor shall be advised prior to drilling through structural sections, for determination of proper layout. Routing shall be located so as not to affect structural sections such ribs or beams.

H. Where conduits, wireways, and other raceways pass through fire partitions, fire walls or walls and floors, install a firestop that provides an effective barrier against the spread of fire, smoke and gases. Firestop material shall be packed tight, and completely fill clearances between raceways and openings. Firestop material shall be in accordance with reference codes standards, regulations, and contract documents.
   1. Floor, exterior wall and roof seals shall be watertight. Walls and floors that are cored for installation of conduit shall be sleeved with steel tubing, grouted and the space between the conduit and sleeve filled as required by Codes and Standards.
   2. Tubing shall extend minimum one (1) inch above finished floor.

I. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factor of 5, which shall conform with any specific requirements as shown on the drawings or in the specifications. In areas inside the institution fence, exposed equipment and materials, including screws and other fasteners, shall be tamperproof. Cover plates shall have beveled edges. Coordinate with Owner, and provide work that meets the security hardware and installation standards established for the institution.

J. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage.

K. Damage from rain, dirt, sun, and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid of flexible waterproof coverings.

L. Conduits shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.

M. During construction, cap the top of all conduits and raceway installed vertically.

N. During installation, equipment shall be protected against entry of foreign matter on the inside; and be vacuum cleaned both inside and outside before testing, operating and painting. Provide painting selected by the Architect & Design Professional.

O. Damaged equipment, as determined by the Architect & Design Professional/Owner, shall be repaired or replaced and returned to operating condition.

P. Painted surfaces shall be protected at all times and protection removed prior to final inspection.

Q. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with same quality of paint and workmanship as used by manufacturer.

R. Perform work as required, indicated, and in compliance with site work. Provide excavation, trenching, backfilling, compacting and resurfacing. Provide seeding and soil stabilization around the entire site, through the perimeter security zones as required for maximum 1% false alarm rate per month, for all systems.

3.3 ADJUSTING, TESTING AND CLEANING

A. Substantial Completion requirements are as follows:
   1. All systems shall be completed and operational, and all controls shall be set and calibrated at SUBSTANTIAL COMPLETION.
   2. All testing, start-up and cleaning work shall be complete at SUBSTANTIAL COMPLETION.
   3. All requested modifications to software, Graphical User Interfaces, CCTV, intercom/paging and duress system have been completed.

B. All bright metal or plated work shall be thoroughly polished. All temporarily pasted labels (except warning/ID labels), dirt and stains shall be removed from the devices.

3.4 SYSTEMS CERTIFICATION

A. The Contractor shall be responsible for Total Quality Control Management for all work provided. Provide certification of the following in regards to the systems:
   1. The SSC shall inspect, test, and adjust systems as required to meet the operational, performance and reliability requirements. When all systems are operating as specified, the Contractor shall schedule and organize joint testing with Architect & Design Professional and Owner.
   2. The SSC shall provide joint testing and certification with the Owner designated inspection firm, Local Authorities Having Jurisdiction and Architect & Design Professional.
   3. The SSC shall submit complete Certifications and test results. Refer to Certification Forms included with the Contract Documents.
   4. The Contractor shall provide a separate certification for each system.
   5. The system certification shall attest that the system provided meets the operational criteria established by the Contract Documents and the requirement of codes, standards, and regulations applicable for the system.
   6. A manufacturer's representative shall be present during each System Testing and Certification.

B. After all final tests and adjustments have been completed and approved by the Architect & Design Professional/Owner, a competent employee of the SSC shall be provided to instruct the Owner's Representative in all details of operation and maintenance for equipment installed. Make available as required, qualified personnel to assist in operations of all equipment for a period of 30 days to assure that Owner's Representatives are qualified to take over operation and maintenance procedures. This Contractor operation period shall be provided on dates specified by the Owner. Instruction periods shall be as designated by the Owner and shall not necessarily be consecutive. Manufacturer's representative shall conduct training on specialized electronic systems as described in Section 280510 Paragraphs 1.14 through 1.18.

C. The SSC Contractor shall submit separate recommended INSPECTION, TESTING AND PREVENTIVE MAINTENANCE PROCEDURES for each system.

3.5 WARRANTY

A. All work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the work of all other Trades resulting from same, shall be replaced or repaired as directed by the Owner's representative.

B. The SSC shall provide to the Owner a written guarantee that the installation, including controls and all other equipment covered under each section of the specifications, performs in an efficient and satisfactory manner.

C. The SSC shall warranty all phases of the system (including, but not limited to, software, hardware, peripheral equipment) for a period of two (2) years from the date of written final

acceptance against defective materials, design, and workmanship. The SSC shall include all preventive maintenance, parts, and servicing required for the systems provided under Division 28 to be continuously operational. The SSC shall provide all preventive maintenance work necessary to maintain the systems in continuous operation through the warranty period. The SSC shall provide all parts required for warranty service, in addition to any spare parts specified in other specification Sections which are intended to be used by the Owner for non-warranty servicing. Upon receipt of notice from the Owner of failure of any part of the warranted system, the SSC, with the assistance of the supplier, shall promptly replace or repair the defective component to restore an acceptable system at no cost to the Owner.

D. The warranty period shall commence upon substantial completion. Acceptance tests and procedures shall be developed by the SSC and accepted by the Architect & Design Professional/Owner.

E. During the warranty period, there shall be no charges to the Owner for service calls including mileage, labor, travel, expense, etc. for warranty work. The SSC shall submit itemized warranty costs for each year. The costs associated with warranties provided by the SSC shall not be paid to the SSC with the construction costs. The Owner shall pay for satisfactory warranty servicing semi-annually after completion of each semi-annual service period. The SSC shall submit costs and documentation required for Owner's budget planning and contract management.

F. Maintenance and Service:

1. This service shall consist of supplier's factory trained representative providing the following:
    a. Personnel factory trained by the manufacturers of the system's components.
    b. Authorized representative of the manufacturer and have an agreement of factory support.
    c. Provide on-site inventory of spare parts to support the "Systems Response Requirement" listed below. Spare parts to be stored at the facility. Spare parts shall remain the property of the Owner after expiration of the manufacturer's service period.
    d. Five (5) years experience minimum servicing systems of the type included in this project.
    e. Capability of making additions or changes to the software systems used in this project.
    f. Capability of servicing the individual system components and the total integrated system.
    g. All test equipment.

G. Service Requirements- Guarantee service response requirements shall include the following:
1. 24-hour telephone number.
2. Service organization shall have a site response time of not more than four (4) hours and be able to restore the system to service within eight (8) hours after being notified.

This service shall be on a 24-hour per day basis every day of the year, including weekends and holidays.

3. Shall maintain current set of system documentation including but not limited to the following:
   a. Wiring diagrams, system diagrams and schematics.
   b. Operation and maintenance manuals.
   c. Software programs with flow charts or other appropriate troubleshooting documentation.
   d. Other documentation as required to provide assistance to the Owner's qualified technical representative on the operation and maintenance of the systems.
   e. All documents shall be made available to the Owner upon request.
   f. Upon termination of maintenance agreement, all system documents, or copies of such, shall be furnished to the Owner for maintenance continuity.

H. Provide technical personnel and spare parts conveniently located, to ensure that the Mean Time to Service/Repair (MTTS), of any malfunction/system failure to be maximum eight (8) hours. MTTS shall be defined as the required time to return the malfunctioning system to normal operations, calculated for any three-month period.

I. Provide the Inspection and Preventive Maintenance Service specified below with each year of the warranty period:
   1. Two (2) routine inspections/year. The Contractor shall provide an inspection plan which ensures that all system components are inspected, adjusted and reconditioned or replaced if necessary at least one (1) time/year.
   2. The Contractor shall provide an emergency service plan which guarantees that the systems provided under this contract are completely functional within 24 hours from the time the Owner have placed the service call.
   3. The Inspection shall include all parts and labor.
   4. The SCP shall include telephone number, name, and address of company, department, manager, and service personnel assigned for servicing the systems provided under this contract.
   5. The Inspection and Preventive Maintenance program shall include the total cost of all services included, terms, and conditions of payment.
   6. Provide minor changes to software, Graphical User Interface screens and PLC to accommodate the Owner changes required for operations, e.g., changes such as icon locations and coloring, room names and numbers, interlocking, reports and printouts. These change periods shall be coordinated with the Owner during the first year of operations.

3.6 SOFTWARE AND ARTWORK SAFEKEEPING

A. At SUBSTANTIAL COMPLETION, and min. 4 weeks before FINAL ACCEPTANCE, the SSC shall deliver to the Owner, under signature, the following Software and Original Artwork:
   1. All Standard Operating/Application Software Source Code used for this project.

2. All Custom Operating/Application Software Source Code and required compilers specifically developed for this project.
3. All Diagnostic Software Source Code and Reporting facilities.
4. All Systems Databases.
5. All Original Artwork for Control Consoles and Graphic Control Panels in AutoCAD file format and film format.
6. Hard copy of all software and artwork delivered as described above.
7. User Instruction Manuals for all software and systems.
8. One (1) spare, ready to use touchscreen monitor for the Control Console.

B. At final acceptance, the SSC shall deliver AS-BUILT/RECORD drawings and details.

C. Software Source Code shall be locked up in a Security Fireproof Safe by the Owner to ensure capability for the Owner to continue operation for minimum 10 years. Source Code shall not be divulged or copied for any other reason.

END OF SECTION 28 05 00

SECTION 28 05 10- SPECIAL REQUIREMENTS FOR SECURITY SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The requirements of Division 1 of these Specifications apply to the work of this Section. This includes the INVITATION TO BID, INSTRUCTIONS TO BIDDERS and GENERAL CONDITIONS.

B. Refer to all contract drawings and specifications listed in Section 28 05 00 for additional requirements.

1.2 QUALITY ASSURANCE

A. All materials and equipment shall be new unless specifically stated otherwise. The specifications establish the standards of quality required, either by description or by references to brand name manufacturers.

B. Where one product only is mentioned by name, the Contractor shall base his bid on the use of the name product.

C. When the equipment is relocated to a place other than that shown on Contract Drawings, or when equipment other than that specified is used, the Contractor shall pay the extra cost of required revisions such as structural steel, concrete, electrical, piping, etc.

1.3 SUBMITTALS

A. Submit all schedules, test plans and procedures, training materials, spare parts lists and requested samples. Submit certification and Warranty Documents. Submit Operation, Maintenance and Programming Manuals. Submit shop drawings, product data, bill of materials, riser diagrams, details and point-to-point wiring diagrams. Submit all documents as outlined in the various Division 28 specifications.

B. Refer to Table 28 05 10-1 and specific submittals listed in any Division 28 Section.

1.4 PRODUCT DATA AND SYSTEM RECORD MANUAL

A. Product Data Manual shall include manufacturers' cut sheets for products used for this Project. Divide the manual to include a separate chapter or volume for each specification listed in Division 28.

B. System Record Manual shall include as-built / final information and data for the products used for the Project. Structure this manual similar to the Product Data Manual including separate chapters for Spare Parts and Equivalent Products.

1.5 SHOP AND SYSTEM RECORD DRAWINGS

A. In addition to the technical proposal submittal requirement of the General Requirements for Security and Communication, all work shall be based on approved Shop Drawings and referenced product data.

B. All Shop Drawings, submittals, catalog cuts, equipment datasheets, calculations and as-built documentation shall be stamped approved, signed and dated prior to forwarding to Design Professional. Unsigned documents shall be returned unreviewed for such stamping.

C. The Shop Drawings shall be provided no later than 60 days after Notice to Proceed and include items and references listed as follows:
   1. Reference Contract Document Identifications for Specifications and Drawings.
   2. Product data, bill of materials, list prices.
   3. Calculations, graphs, tables, references to codes, standards, and regulations.
   4. Installation details including dimensions in reference to site and building elements, references for material type, color and aesthetic integration as required.
   5. Single line diagrams indicating the required equipment, cabling, cable labeling.
   6. Point to point diagrams, including single point grounding, indication of type of termination of each cable, conductor, and cable shield.
   7. Equipment wiring details as required to provide complete connection information in conjunction with the point to point diagrams. Submit cabling schedules that uniquely identify each wire, consistent with the point-to-point diagrams.
   8. Control Equipment Layout/Configuration including dimensions, details, and references for color and aesthetic integration.
   9. Graphic User Interface software screen shots.
   10. Submit for Owner records the software artwork listed below.
      a. Original software and software descriptions and manuals for all Security and Communication Systems.
      b. Complete software database and database printout for all special systems software and database as of date of acceptance of the Special Systems by the Contracting Officer on removable hard disk or floppy disks as applicable. All software shall be labeled with manufacturer's name and software version number. All custom software shall be appropriately labeled. All software shall be accompanied by a user's manual. A complete database printout shall be attached to the user's manual.
      c. AutoCAD files of all artwork, touch control graphics and all other graphics used on this project.
   11. Spare Parts Manual- Submit spare parts manual containing list of recommended spare parts, equipment, and materials, including firmware, software, and memory chips. The spare parts list shall include all parts that can render a system in one or multiple buildings inoperable as described in Division 28 Specifications and any parts that are not in the service organization's inventory and cannot be delivered to the site within 24 hours. For each item listed, provide the information listed below.
      a. Manufacturer's name, address, phone number.
      b. Manufacturer's model, series, version, and GSA number, as applicable.
      c. Mean time before/between failure (MTBF).

d. Number of devices of same type used for this project and number of spare parts recommended to be stored on the site.
e. Current approximate delivery time.
f. Current list price.
g. Product data and description of operation, including list of equivalent parts, if applicable.

D. The System Record Drawings shall include all as-built conditions and information pertinent to this project.

1.6 DEMONSTRATION- HARDWARE AND SOFTWARE

A. No later than 120 days after receipt of the Notice to Proceed (NTP), and after the approval of the product data and shop drawings, the SSC shall demonstrate the operation of the Control and Processing hardware and software portion of Security and Communication Systems. The demonstration shall be completed to the satisfaction of the Design Professional/Owner.

B. The demonstration shall include at least one input as if received from each of the systems specified, and prompt operator input data to accomplish the proper sequence of operations as indicated in this Section and the Description of Operation for each individual control center and officer station. Provide enhancement of software and/or hardware which performs unsuccessfully or does not meet the requirements specified.

C. After all corrections have been made, the SSC shall notify the Design Professional who will recheck the systems for compliance of all items listed.

D. Submit demonstration procedure for review 30 days prior to the demonstration. Changes as desired by the Design Professional/Owner shall be incorporated into the demonstration procedures prior to the demonstration. If the Contractor elects to provide the demonstration at a location other than the project site, the SSC shall provide travel and accommodations to two (2) Agency personnel, two (2) Owners' Representatives and two (2) Design Professionals for each review period.

E. Demonstration shall show complete integration of at least one working component of each type of outboard system.

1.7 AS-BUILT DRAWINGS

A. The Contractor shall keep his on-site blueprints up to date at all times. All wiring shall be marked and indexed for permanent record and submitted with as-builts.

B. When field work has been completed, and before final inspection, deliver to the Owner’s Representative a complete set of prints, marked in colored marker, to show all changes made in the drawings so as to indicate the work as-built. Include dimensions from reference points for any concealed work (junction boxes, etc.) requiring future access.

C. The Contractor shall provide the Design Professional with the as-built drawings in electronic CAD format (.dwg format). The electronic CAD format of the as-built drawings shall provide the same information as provided on the complete set of paper as-built drawings.

1.8 SERVICE AND TECHNICAL ASSISTANCE SCHEDULE

A. Provide a system servicing schedule shall include the information described below.
   1. Typical System Failures: Information that must be known by Owner's system operating personnel before calling for services. Provide service log for recording all date and time of service calls, type of failure, description of the repairs, time to repair and service person's name and telephone, date, time when the system was returned to normal operation.
   2. Service and Technical Assistance personnel and phone numbers schedule. The personnel, department representatives shall be those normally assigned by the contractor/system servicing company for the type and size of the systems installed under this project.

1.9 ADJUSTING OF SYSTEMS

A. All system components shall be adjusted for optimum performance under the local conditions particular to the project.

1.10 TEST PROCEDURES MANUAL

A. Submit for review and approval a System Test Procedure Manual for each system to include the data listed below.
   1. Test procedures for partial and total system testing.
   2. System adjustment schedule to include all system components that require adjusting.
   3. Typical Test Record Forms which will be used for recording test results. Cabling test record forms shall identify each cable consistent with the cabling schedules required.

1.11 TEST RECORD MANUAL

A. Submit a System Test Record Manual for each system to include the actual measurement data, as listed below.
   1. Approved test procedures.
   2. System adjustment schedule.
   3. Test records with actual test results, recorded on approved Test Report Forms.
   4. List of test equipment used.
   5. List of typical test conditions.
   6. Date and time of testing.
   7. Name and telephone number of the organization and person who performed the testing.

1.12 SITE TESTS

A. Include partial, work phase and end-to-end testing necessary to verify and record on approved Test Report Forms the compliance with applicable codes, standards, regulations, manufacturer specifications and Contract Documents.

B. As a minimum, the site tests shall include:
   1. Testing of all assemblies.
   2. Testing of individual equipment for each function.
   3. Testing of all cabling for shorts, opening, grounding, and visual inspection for physical damage and labeling.
   4. Testing of all inputs and outputs and functions.
   5. Testing of all system configuration available by programming, switching, or adjusting.

1.13 SYSTEM ACCEPTANCE

A. Schedule THE FINAL ACCEPTANCE TESTS with the Owner at a mutually agreed time. Contractor shall notify the Owner a minimum of 2 weeks in advance of the intended final acceptance time.

B. Should any part of a system fail during the acceptance tests to perform according to the Contract Documents the entire system shall be retested at an Owner selected time and date.

C. Correct deficiencies unacceptable to the Owner and provide a complete and functional system.

D. Record and submit to the Owner the final test results as specified herein.

E. Acceptance: Systems will not be accepted by the Owner until deficiencies have been corrected.

F. Beneficial use of systems by Owner will not be considered as an acceptance.

1.14 TRAINING

A. Provide training of Owner’s selected representatives for operation, maintenance, and programming.

B. Operation and Maintenance, Programming Manuals: Provide a copy of Operation Manuals, Programming Manuals and Maintenance Manuals to each of the participants to the training. Minimum eight (8) sets of manuals are required. Provide computer files with the contents of the training manuals.

C. Training sessions shall contain all information necessary for correct and effective operation, maintenance, testing, adjusting, and programming of each system component.

D. Effective Training Periods. Preparation, set-up, and testing times shall be included in addition to the minimum training sessions.

E. Typical training sessions shall be in the quantity and durations defined in the Training Schedule in this Section.

F. Provide typical one page flow charts for operation, testing, programming, and troubleshooting in a format that is ready for framing.

1.15 TRAINING FOR SYSTEM OPERATION

A. Relate the operation training to the contents of the Operation Manuals, described herein.

B. Operation and Maintenance Manuals shall contain:
1. Sequences of operation shown on actual graphic representation of the signals and controls provided.
2. Operation Flow Charts (OFC) and descriptions.
3. List of information the System Operator have to gather and log in the service log, before calling for service or technical assistance.
4. List of contractor and manufacturers authorized service and technical assistance representatives, their telephone numbers and normal business schedule.

1.16 TRAINING FOR PROGRAMMING

A. Relate the contents of the training sessions for programming to the contents of the Programming Manuals. Provide minimum eight (8) Programming Manuals for the systems listed.

B. The Programming Manuals shall include:
1. Control Consoles, Officer Stations, Graphics Panels, and Master Stations, typical task-oriented flow charts. As a minimum the following tasks are required: data entry, configuration, review, report generation, diagnostics, start-up.
2. Program troubleshooting flow charts.
3. List of information the system programmer is required to document before service or technical assistance calls.
4. List of contractor and manufacturer authorized service and technical assistance representatives, their telephone numbers and normal business schedule.
5. List of Firmware and Software versions available for the system provided for this Project, description of the various characteristics of the firmware and software in terms of benefits to the end user.
6. System upgrading characteristics and relocation information including hardware implications.

1.17 TRAINING FOR SYSTEM MAINTENANCE

A. Relate the maintenance training to the contents of the Operation and Maintenance Manuals, described herein.

B. Operation and Maintenance Manuals shall contain:
   1. Testing and Adjusting Flow Charts, and descriptions.
   2. Troubleshooting Flow Charts, and descriptions.
   3. List of information the System Operator has to gather and enter in the service log, before calling for service or technical assistance.
   4. List of contractor and manufacturers authorized service and technical assistance representatives, their telephone numbers and normal business schedule.
   5. Spare parts schedule, with recommended spare parts list for the type, size, and complexity of the system provided under this project.
   6. Product data.
   7. System Record Drawings.

1.18 TRAINING VIDEO DVDS

A. Provide Training Video DVDs in standard format. Provide separate video DVDs with all training required for operation, programming and maintenance of the systems provided under this contract. The training DVDs shall closely follow the content of the training manuals and the on-site training provided. The video training DVDs shall include titling for each operation, programming and maintenance function. Contractor shall ensure that the video recording equipment is synchronized with all project video sources to avoid shadowing and blanking. At the minimum the training video DVDs shall include the information listed below.
   1. The Operation video training DVDs shall include all relevant information for operation of all devices provided. The training shall address interpretation of each signal, required operator actions, the sequence of operator actions, all operator follow up and reporting functions shown on graphical user's guide. Provide detailed demonstration of back-up, restoral procedures, emergency operations including power failures, partial and system failures. Refer to Operator Manual specifications, for additional requirements.
   2. The Programming video training DVDs shall include all relevant information for programming of all devices provided. Provide interpretation of error messages and required debugging. Refer to Programming Manual specifications for additional requirements.
   3. The Maintenance video training DVDs shall include testing, diagnostics, interpretation of results and inspection procedures. Provide detailed preventive maintenance procedures demonstrated through visual inspection, testing, cleaning, replacement, and reconditioning of parts.

1.19 SPECIAL TOOLS, EQUIPMENT AND MATERIALS

A. Deliver to the Owners representative all special tools, equipment, and materials necessary to maintain the system provided under this Contract. A list of all special tools, equipment, and materials associated with each system shall be submitted to the Owner minimum 2 weeks prior to final acceptance test.

B. All electrical work documented on drawings or required under the fencing specifications shall be provided in its entirety.

C. Electrical specifications appearing in other Divisions of this set of Contract Documents shall be considered a part of this specification and shall be enforced as if fully described within these special requirements. The specifications for materials and installation of electrical/electronic components specified within Division 02 and Division 13 shall supersede those of any other section.

See Submittal Register on the next page.

1.20 TABLE 28 05 10-1- SUBMITTAL REGISTER

A. The Contractor shall submit coordinated drawings, manuals and test results for "EACH" system specified under Division 28. Refer to individual system specification sections. Submittal register to include submittals for electric power calculations, emergency power distribution, and UPS power distribution schedules. All submittals shall be stamped-approved by Contractor, signed and dated prior to review. Unsigned materials shall be returned for such approval.

		Submit For			
Specification Sections	Description	Review	Approval by Owner &/or Design Professional	Records	Comments/ Reference Sections
Applies for Division 28	Detention Equip. & Special Systems Qualifications Performance Bonds	X	X	X	
	Product Data	X	X		
	Shop Drawings	X	X		
	Demonstration Procedures	X	X		
	Demonstration	X	X		
	Test Procedures Manual	X	X		
	Test Record Manual	X	X	X	
	Systems Record Manual	X	X	X	
	System Record Drawings	X	X	X	
	System Operation and Maintenance Manual	X		X	
	System Training DVDs	X		X	
	System Certification		X	X	
	Software, Source Code and Art Work	X		X	
	Guarantee Certificate			X	

Specification Sections	Description	Review	Submit For Approval by Owner &/or Design Professional	Records	Comments/ Reference Sections
	System Serv. & Tech. Assistance Schedule	X		X	

1.21 TABLE 28 05 10-2- TRAINING SCHEDULE

A. The Contractor in coordination with the system manufacturers shall provide Training Operation, Programming and Maintenance for each system specified in Division 28 as shown on the Training Schedule included in this Section. The system training and training manuals shall be specifically for the systems provided under this project.

Specification Sections	Description	Sessions	Time Each Hours	Comments/ Reference Section
28 06 10	SECURITY NETWORK EQUIPMENT			
	• Operation	1	4	
	• Software	1	4	
	• Maintenance	1	4	
28 13 00	ACCESS CONTROL			
	• Operation	3	4	
	• Software	2	4	
	• Maintenance	1	4	
28 17 00	WIRED DURESS			
	• Operation	1	4	
	• Software	1	4	
	• Maintenance	1	4	
28 50 00	INTERCOM/PAGING SYSTEM			

Specification Sections	Description	Sessions	Time Each Hours	Comments/ Reference Section
	• Operation	3	4	
	• Programming	1	4	
	• Maintenance	1	4	
28 60 00	VIDEO SURVEILLANCE			
	• Operation	3	4	
	• Programming	2	4	
	• Maintenance	1	4	
28 70 00	WATCH TOUR			
	• Operation	1	4	
	• Programming	1	4	
	• Maintenance	1	2	

PART 2 PRODUCTS

(NOT USED).

PART 3 EXECUTION

(NOT USED).

END OF SECTION 28 05 10

SECTION 28 05 20- CONTROL CONSOLES, CABINETS, AND ENCLOSURES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the contract, including the General and Supplementary Conditions apply to this Section.

B. Refer to all Contract Drawings and specification sections listed in Section 28 05 00 for additional requirements.

1.2 DESCRIPTION OF WORK

A. Coordinate the panel installation requirements with the Architect & Engineer and Owner as required.

B. Coordinate all control console work with work provided by other trades.

C. Provide locking type protection enclosures for all electronic devices and modules installed in the control console base. Provide keying as required by Owner. Provide louvers and thermostatically controlled venting for all console sections that house heat-sensitive electronics.

D. The Contractor shall be responsible for the interfacing and integration of all devices and systems with the work under separate Divisions, such as: Fire Alarm Systems and Electrical Infrastructure, Tele/Data Systems.

1.3 DESCRIPTION

A. Control Console – General:
   1. Control console shall be furnished and installed at locations as shown on the Contract Drawings.
   2. The Central Control console located at Central Control shall include sufficient bays to accommodate all equipment. It shall house the Touchscreen Computer systems, the server computer with the database monitor, the Intercom/Paging master stations, and Video Surveillance system equipment including monitors, controllers, and other miscellaneous communications such as telephone systems and control equipment. Contractor to coordinate with other telecommunications providers and Owner for space requirements for miscellaneous equipment.
   3. Consideration will be given to Contractor’s customary production methods; however, the final approval will be made by the Architect & Engineer and Owner.

B. Equipment Racks:
   1. Equipment racks shall be furnished and installed at locations shown on Contract Drawings.
   2. Equipment racks shall be used to mount all rack-mounted equipment.

PART 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS

A. All products are acceptable only upon compliance with the requirements of all Specification Sections and Contract Drawings.

2.2 CONTROL CONSOLES – GENERAL

A. Control console locations shall be millwork as defined by the Architectural design package. Coordinate all dimensional, mounting, and finish requirements.

2.3 CENTRAL CONTROL AND LOCAL WORKSTATION CABINETS

A. Computer workstations in Central Control, Housing Units, Medical, and Booking shall be secured below the desk top surfaces in a secure cabinet.

B. Provide under-work surface racks for computers and miscellaneous electronics.

C. Cabinets shall have the following characteristics:

1. Height 24-1/2” by 20” deep to fit under new work surface.
2. Have a self contained track mounting system with side, top and rear panels.
3. Provide full depth rack shelves for each rack.
4. Support up to 40 pounds of weight.
5. Thermostatically controlled. The noise produced by ventilating equipment shall not exceed 45dBA or 3dB(A) above ambient noise levels, whichever is lower.
6. Forced air ventilated.
7. Steel construction with lockable doors

D. Cabinets shall be Middle Atlantic Slim 5 Series, Winsted Pro Series II, Tripp Lite Smart Rack, or approved equal

2.4 EQUIPMENT RACKS/PANELS

A. Provide quantity of equipment racks as shown on the Contract Drawings.

B. Equipment racks shall have the following features:
1. Mounting rails for standard 19” equipment.
2. Top, bottom and side panels painted black.
3. Wireways and wire management features to allow for proper workmanship, routing, bundling, securing, and dressing of all cables.
4. Fans, louvers, filters, and thermostat control for the clean efficient exhaust of heat from the enclosure.
5. Pull-out light source shelf with movable and extendable light sources (min. 2) to assist with detailed rack work and identification.
6. Draw-out tray to place papers, laptop or tools during rack access or work.
7. Power strips for equipment connection with 50% spare capacity.

C. Racks shall be placed in rooms to allow code-required access to front and rear.

D. Rack power strips shall be powered through UPS-backed power circuits.

E. Racks shall be bolted to the floor.

F. Cables shall enter racks overhead from the cable tray system or wire management system. Cable tray curved, ladder-type, dropout connectors shall connect between the bottom of the cable tray and top of rack. All cables shall be secured to the connect rung.

G. Floor-mounted racks shall be as manufactured by Middle Atlantic WRK Series, or approved equal by Winsted or Hubbell.

2.5 EQUIPMENT ROOM AND CONSOLE WIRING

A. All control room wiring shall be concealed and run in metallic channel type raceways except for up to 6” runs from the wiring channel to the individual equipment termination points.

B. The system wiring shall allow for easy and efficient servicing.

C. Provide DIN rail mounted, UL listed connectors as manufactured by Phoenix, Allen Bradley, or equivalent. Provide surge protection at/with the terminal boards and connectors for each circuit connected to devices and systems outside of the Building. Electric power to distribution panels and boxes are specified in Division 26. The Contractor shall provide electric power to the console and security systems equipment. The Contractor shall coordinate all work provided under this contract with work provided by others as required to meet the intent specifically described herein.

D. The Contractor shall ensure that all signal transmissions, switching and processing meets the manufacturer's requirements for phase and synchronization.

E. Coordinate UPS/Power distribution panels, circuit breakers for Security Systems equipment with Electrical provider specified elsewhere in these specifications. The neutral conductor will be bonded to the building master ground system as required under NFPA 70, NEC, Article 250-74.

F. All electric power circuit conduit and boxes shall be metal.

G. The Contractor shall provide branch circuits, wired individually from the dedicated circuit breaker power/UPS panels using minimum three #12 AWG wires. Every powered device shall have a direct path to the unipoint ground busbar without noise being injected by other outlets.

H. The Contractor shall provide insulating materials, as required, to isolate equipment racks from all conduit, outlet boxes and raceway components.

I. The Contractor shall use isolation techniques, as required, to isolate equipment racks from ventilation ducts and building steel.

J. The Contractor shall provide in each rack, a copper busbar as an isolated ground unipoint- for connection of grounding conductors used for the equipment in that rack.

K. The Contractor shall provide connection of each rack's busbar to the ground busbar in the circuit breaker panel using #4 AWG insulated copper conductor.

L. The Contractor shall provide connection of each rack's ground busbar to the rack frame by means of a tightly attached lug and connection shall be made between lug and ground busbar using #12 AWG stranded wire, type TW.

M. The Contractor shall coordinate with the Division 26 work all electrical power, grounding, and surge protection as required to meet the provisions of NFPA 70- National Electric Code, Article 250-74 for isolated ground type installations.

N. For 600 volt and lower voltage power conductors, Burndy clamp type solderless connectors shall be used in making up taps, splices, and connections, and shall be padded with Scotchfil electrical insulation putty and taped with Scotch electrical tape no. 33, unless otherwise specified. As an alternative, connector may be insulated with a homogenized rubber based insulating compound backed by sheet vinyl equal to Scotch "E-Z Seal" #2200 (pads) or #2210 (tape). Such insulating compound shall be over-wrapped with (2) layers of PVC electrical tape.

O. Any splices shall be made up with butt spaces, crimped with approved tooling.

P. Provide code required fire stopping at all fire rated wall, floor and partition penetrations with UL listed fire stopping materials such as 3M Fire Barrier CP255/L and 25N/S caulk, or approve equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
1. Provide all materials and equipment as required to construct control panels and consoles to support the requirements of Contract Drawings and Specifications.
2. The SSC shall coordinate installation of all equipment which is to be installed in console.
3. The Contractor shall provide coordination with work of other Divisions as required. Contractor shall provide and install all equipment necessary for interfacing with all related systems.

3.2 ADJUSTING, TESTING AND CLEANING

A. General:
1. Upon completion of the Work, remove excess debris, materials, equipment, apparatus, and tools, and leave the premises clean, neat and orderly.

B. Testing:
   1. Contractor shall test system completely prior to acceptance tests.
   2. Acceptance tests shall be conducted by the Owner or Owner's representative and Architect & Engineer to ensure compliance with plans and specifications.

END OF SECTION 28 05 20

SECTION 28 05 30- OPERATION SEQUENCES FOR SECURITY SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. General Provisions of the Contract, including General and Supplementary Conditions apply to this Section.

B. Refer to Contract Drawings and specifications listed in Section 28 05 00 for additional requirements.

C. Refer to Division 26 and the Electrical drawings for coordination requirements for power and infrastructure.

1.2 DESCRIPTION OF WORK

A. Provide site-wide security and control systems hardware and software and programming as required for the systems to operate as specified in this Section. Provide programming, start-up, testing, debugging through the central processing computers, programmable logic controllers, touch control systems, and printers.

B. Provide systems integration work for complete and functional integrated Security and Control Systems that operate in compliance with the sample generalized sequences of operation described in this Section. These generalized operation sequences shall be used by the Contractor in the development of the technical proposal and systems programming for hardware and software demonstration as specified in Division 28. The Contractor shall coordinate with the Architect & Engineer and Owner as required to implement requirements identified through the demonstration, and to provide final operation sequence that is acceptable.

C. The operator console in the Central Control Center includes the devices listed below:
1. Access Control Computers: Section 28 13 00
2. Multiplex Video Surveillance Monitors, Multiplexer monitors mounted over head: Section 28 23 00
3. Call-Up Video Surveillance Monitors: Section 28 23 00
4. Intercom and Paging Master Stations: Section 28 50 00
5. Control Consoles, Cabinets and Enclosures: Section 28 05 20

D. Touch Control Screens- Hardware, Firmware, Software: The “TOUCH CONTROL SCREENS (TSC)”, shall be equipped with all hardware necessary to meet the following minimum performance requirements listed as follows:
1. Monitor, display, and control all systems, functions and signals as specified, and shown on drawings.
2. Provide a signal generation to signal display and control to execution response time less than 0.75 seconds including associated graphic maps and control displays

associated with each type of signal and action specified, and shown on drawings. Typically the graphic maps displayed with each signal shall provide all details, labeling and control areas necessary and applicable to display and control the active system as described herein.

3. Provide hardware, firmware, software, and programming necessary to maintain and meet the response time, performance, reliability and operational requirements.

1.3 TOUCH CONTROL SCREEN- SYSTEM DESCRIPTION

A. Provide interfacing and programming for "TOUCH CONTROL SCREENS (TSC)" and distributed processing equipment to meet the following minimum performance requirements:
   1. Provide an Access Control System workstation for each Touch Screen location. Refer to specification section 28 13 00 for additional workstation details.
   2. Activation of two (2) or more touch control areas within one second shall have no effect to any system. Provide timed sequence type controls for critical functions required such as "Sally Port Interlock Override".
   3. Activation of the touch control system lockout function shall deactivate the TCS until the operator accesses the control station by using an authorized password. The time interval necessary for completely operational state of a terminal shall be three seconds maximum from the time of entering a complete system password via the appropriate text terminal.
   4. An incoming signal shall cause the appropriate system designated symbol in the system selection and control area to flash. Flashing shall be interpreted as a change of the color or brightness unless specifically stated otherwise.
   5. TCS terminal shall provide for answering incoming or active signal.
   6. Control systems shall assist the operator in answering an incoming signal by flashing the applicable control function related areas and indicating any interconnections and relations between systems in the sequence specified and appropriate related systems.
   7. Control systems shall display individual status related statistics such as zone or area number of alarm, supervisory, trouble, queued signals in the touch control systems status display area.
   8. Queued signal shall be returned to the console/operator station which issued the queuing request after an adjustable time interval. If the terminal which issued the queuing request is in a lockout mode or is otherwise inaccessible to the control systems, the queued signal shall be sent along with a sequential description/tally to the other terminals or the other operator station (coordinate with the owner). The description/tally shall indicate as minimum:
      a. Time, date of origination.
      b. System, type of signal and device.
      c. Monitoring point.
      d. Operator station which originally answered the signal.
      e. Operator actions related to the signal.
   9. Activation of a general alarm, systems control function such as acknowledge, test, access, queue and reset shall change a flashing colored control area to a steady control area display consistent with system specific color code.
   10. Selection and activation of system controls such as door or gate control, access control card readers, watch tour, duress, video surveillance, paging, and control points, zones

and areas shall be via site or floor graphic maps unless specific control functions require special commands as specified and as directed by Owner and A/E. All system-specific control sequences shall be typed as specified for the particular system.

11. Activation of graphic display touch control area shall provide for the control area color to flash until the appropriate graphic display is completed at which time a steady bright color shall be displayed.
12. The touch control system terminal shall provide for manual access of any system through the systems selection and control menu displayed at all times when a particular terminal is active. All systems related manual access shall require two steps.
    a. First, touch control area activation- cause the respective touch control area to flash and the word “manual” to be displayed under the control area.
    b. Second, touch control area activation- cause the display of particular system related control and classification menus and site plan.
13. Manual access of door or gate and intercom control functions shall cause the same Video Surveillance/display and control functions as described for automatic call-up.
14. Manual access of Video Surveillance system control functions shall be as described in this Section under the appropriate system operation part.
15. Manual activation of paging intercom and door/gate control keys in the system selection and control menu shall automatically engage the intercom and paging menu.
16. Activation of the site key plan graphic control key in the system selection and control menu shall provide for the site plan to be displayed on the entire screen area above the system selection and control menu. An incoming signal shall provide for the display of the appropriate sector/quadrant map and activation of the graphic display control menu to allow the operator to perform a closer inspection of the signal origination area. Provide direct one step access to different sectors/areas of the Site and to buildings through a hyper graphic key plan. Provide direct one step access to the complete Site plan through a dedicated icon/graphic button. Identify the location of each control console on the graphic display.
17. Activation of the clear screen key in the systems selection and control menu shall allow the operator to blank a terminal temporarily. Incoming signal addressed to the particular terminal shall activate necessary monitoring, display and control function associated with the particular terminal. Activation of the clear screen shall have no effect while active signals are addressed to the terminal unless a system error condition validates its action. If clear screen function is validated, all active signals shall be automatically transferred to the other operator terminal or terminals as necessary to provide for operators to respond as required.
18. Activation of the touch control system test key in the systems selection and control menu shall provide for the respective touch control system to run through a complete diagnostic and provide a plain English report of the results. Activation of the system test key while active signals are addressed to the terminal shall have no effect.
19. Activation of the cancel command key in the system selection and control menu shall stop execution of the last command and return all systems to their status prior to issuance of the command. The system shall display and announce any potential danger associated with the cancellation of the command. For example, closing a gate while people attempt to pass through. The systems shall require the cancel command to be activated for the second time within three seconds if the cancellation of a

command would place people in danger. The cancel command key shall provide the operator to cancel one command within ten seconds interval.

20. Activation of the touch control system reset key in the system selection and control menu shall provide for the respective touch control system to reset, run a complete diagnostic, and provide a plain English report of the results. Activation of the touch control system reset key while active systems are addressed to the terminal shall have no effect; the signals addressed to the particular terminal shall be transferred to a different terminal for the touch control system reset key to become active.

B. Typical Touch Control Screen Configurations: The touch control system shall process and display, as a minimum, the Graphical User Interface (GUI) type systems control and monitoring terminal configurations listed below:
   1. Door/Gate Control:
      a. Systems Selection and Control.
      b. Door/Gate Alarm, and Video Surveillance Camera Automatic Call-up.
      c. Card Reader Monitoring, Logging, and Reporting.
      d. Signal Classification.
      e. Door/Gate, Graphic Map Display and Control for Intercom, and Paging Systems.
      f. Report Generation with repeated updating of data regarding dispatching of incident response teams, the actions, and findings of the incident response teams and operators, and security and maintenance follow-up required. Each event update shall include date, time, operator identified – maximum security alert operating mode only.
      g. Emergency Release.
      h. Selective Group Unlocking and Locking.
      i. Interlock Override.
   2. Video Surveillance System (VSS):
      a. Systems Selection and Control.
      b. Video Surveillance- Manual Control including Pan, Tilt, Zoom (PTZ) controls through touchscreen.
   3. Intercom/Paging:
      a. Station/substation selection.
      b. Paging zone control.
      c. Page exterior/interior.
      d. All Page Center Control.
   4. Wired Duress Alarms:
      a. Wired Duress displayed on GUI screens.

C. Touch Control and Graphics- Default Color Selection:
   1. Use the following color rules for establishing color combinations that provide good contrast and visibility:

a.	Overall Screen Background	Light Gray/White
b.	Control Area Symbol Outlines/Contour/ Frames, Labels/Text	Black

c.	Label and Symbol Display Area	White
d.	Interconnect Label Area	Yellow

2. Use the following color rules for establishing systems selection and control menu touch control foreground area colors:

a.	Perimeter	Pink
b.	Door/Gate Control	Blue
c.	Video Surveillance	Green
d.	Intercom and Paging/Audio Com	Magenta
e.	Graphic Annunciator	Green/Red/Orange
f.	Clear Screen	Blue
g.	Touch Control System Test	Orange
h.	Cancel Command	Red
i.	Touch Control System Reset	Red
j.	Touch Control System Lockout	Magenta

3. System control standard or default foreground area colors are:

a.	Acknowledge	Magenta
b.	Test	Orange
c.	Access	Cyan
d.	Queue	Blue
e.	Reset	Red

4. Signal classification control standard or default foreground area colors are:

a.	Unknown	Magenta
b.	Wildlife	Green
c.	Weather	Orange
d.	Accidental False	Cyan
e.	Deliberate False	Blue
f.	Real	Red

5. Symbol standard or default colors are:

a.	Perimeter	Magenta
b.	Motion Detection	Black
c.	Door/Gate Control	Black
d.	Video Surveillance	Green
e.	Intercom and Paging/Audio Com	Blue
f.	Lighting/Utilities	Orange

6. Standard example of default touch control graphics development- Perimeter Security System:

a.	Control Area Outlines/Contour	Black
b.	Foreground (Touch Control Area)	Pink
c.	System Label Area	White
d.	System Label	Black
e.	System Symbol	Red
f.	System Interconnect Area	Yellow
g.	Interconnect Label	Black

7. Where touch control area foreground colors are not established by these specifications, the Contractor shall develop the coloring scheme based on use of alternating colors such as red, orange, green, blue, magenta and cyan.
8. Overall contrast, brightness shall be adjustable to provide operators with graphics which are distinctive for particular signals and can clearly be seen in the lighting conditions of the control center.
9. Graphics, color combinations, and systems adjustments shall be developed by the touch control systems manufacturer and confirmed with the Owner.

10. Graphics and symbols developed for the touch control systems shall be to allow a color blind operator to recognize a function or control area without knowing precisely which color corresponds to which command or signal.
11. Flashing signals shall be outside of labeling and other text areas and flashing signals shall determine variation of screen area brightness without actually blanking out an area or removing a graphics from a control area.

D. Integrated Special Systems- Priority Levels:
1. When two (2) or more systems send signals to the operator stations, the following priority list shall be used in establishing the order in which they are displayed and controlled via GUI touch control terminals and graphic control panels.

a.	Staff duress signal	Priority 1- Highest
b.	Perimeter, Motion Detection, Video Surveillance Alarms, Perimeter Doors	Priority 2
c.	Door/Gate Control, Intercom	Priority 3
d.	Other	Priority 4

1.4 SEQUENCES OF OPERATION

A. Sequences of Operation described in this Section are generalized representative samples which shall be used for development of the submittals. Provide programming of final operation sequences to include all requirements coordinated and finalized through the system demonstration and final acceptance testing process.

1.5 SYSTEM OPERATION- STANDARD FOR TOUCH CONTROL SYSTEMS

A. Provide systems that are programmable to include alarm, trouble and supervisory signal as EXCEPTION/CRITICAL EVENTS. The Touch Control System terminals shall allow the Control Center to operate in Degraded mode with no report filing requirements, MAXIMUM SECURITY/ALERT MODE where report filing is required for critical events and any mode combinations for each system (between degraded and maximum alert mode) as required by Owner during final acceptance testing. The SEQUENCES OF OPERATION included in this Section are provided as guidelines to develop all sequences required for this Project.

B. Movement Control- Operation Sequence: When multiple intercom calls/door, gate access requests are placed the operator shall perform the tasks listed below:
1. Select intercom station on the touchscreen- establish voice and video communication.
2. Unlock the door (unlock and open the gate) by touching the icon on the touchscreen.
   a. Where Video Surveillance is provided, the camera displayed shall change when an intercom or camera is selected through the touchscreen or keyboards.
3. All card reader controlled doors shall be monitored for status and status of door shall be displayed on TSC. Unauthorized access shall cause an Alarm condition at the local station as well as the Central Control Center (CCC) station. Card reader controlled

doors shall have the capability to be overridden by local control with proper password protection or CCC control.

C. Video Surveillance System (VSS):
1. TCS, Computer, ACS, and VSS systems shall be integrated to provide for automatic and manual operation of the VSS system as specified in this Section and Section 28 60 00.
2. VSS normal default operating mode shall be automatic as specified and directed by Architect/Engineer and Owner.
3. When operators desire to control the VSS system in a manner different than the automatic functions, they shall be provided with necessary manual control functions for the following:
   a. Selection and control of cameras.
   b. Selection of display location for each camera and each recorded video signal.
   c. Selection of display configurations for each monitor.
   d. Selection of recording and replay conditions and configurations.
4. VSS manual control functions shall allow the Owner to change system configuration for both automatic and manual modes and menus.
5. Automatic and manual operation, preset and default settings, signal sequencing, function assignments and other operational and programming requirements shall be confirmed with Architect/Engineer and Owner.
6. VSS Control – Manual:
   a. VSS and touch control systems shall provide for the manual control functions listed below:
      1) Graphic map control mode- When activated shall call up Graphic Map (GM #1) Site Plan and the graphic display control menu.
      2) Operator shall be able to select a particular area/building for which VSS is provided by touching the map.
      3) Pan, tilt, zoom control shall be provided when the enlarged area map is displaying an area where pan tilt, zoom type VSS is provided. Pan, tilt, zoom control functions shall provide for momentary speed control with feed back (control area color illuminated) such that at the time of control release the pan, tilt, zoom stops. Provide minimum of three speeds. The system shall execute the pan tilt, zoom control functions received from the first operator. When controls are released by this operator, then they become available for others.
      4) Upon operator's touch command on map, selected camera shall be called-up for automatic operation.
7. Manual menus shall control how video image, being received from any VSS camera installed is displayed on the monitors that are installed in the control center. Cameras that are equipped with pan, tilt and zoom features are also controlled from these menus.

D. Door/Intercom Control Systems:
1. Traffic Control Menu: Controls traffic passing through controlled doors, and monitors their surrounding area by manipulating associated intercom and video surveillance (VSS) systems, retracting (unlocking) lock mechanisms and monitoring status (unlocking) lock mechanisms and monitoring the status (Unlocked/Locked) of doors.

2. Lock mechanism installed on each door and its associated intercom and VSS camera are controlled by the following:
   a. Control area next to each door labeled with a KEY symbol provides control of lock mechanism on a particular door. Visual indication of door status (Unlocked/Locked) is provided by color of the KEY and DOOR symbols respectively where KEY symbol illuminated- unlocked, door symbol dimmed- closed and locked. The word UNSECURE shall be displayed in the status display area whenever a door is open, unlocked or both open and unlocked.
   b. Switch labeled READY controls power to door control areas. Visual indication of power status is indicated by a steady control area color indicating Power On, a dimmed color indicating power off. This control area has no effect on the visual indication of the door status.
   c. Control area and symbol labeled with door associated intercom station number, controls associated intercom and VSS camera operations. The control area color indicates addressing via illuminated color, off via dimmed color signal receiving from the intercom station via flashing color.
   d. Single control area on the graphic map bottom right corner labeled TOUCH TO TALK controls that function for all of the intercom circuits are individually activated by intercom/VSS control areas.
      1) Although CPS is equipped with automatic talk/listen circuitry for normal intercom conversation, the control will manually override the automatic talk/listen circuitry. It should only be necessary to use this manual override, if there is loud background noise at a particular door or a malfunction in the automatic talk/listen circuitry.
3. When intercom/VSS communications are not in progress with doors, associated colors are dimmed. To initiate an intercom call to a particular door, the following will occur:
   a. If appropriate hands-free intercom master station or handset at a particular console operator station has not been activated, procedures above are followed.
   b. If any single intercom/VSS control area is touched and released, its associated color illuminates steadily, audio is received in activated station or handset via the intercom associated with door named on the graphic map; associated VSS display(s), appear(s) on console monitor(s).
   c. Normal conversation should be possible; however, if the automatic talk/listen circuitry is not functioning satisfactorily, the touch to talk control area is touched and maintaining pressure on it while speaking into the wireless headset or handset transmits audio to the active door intercom station. When pressure is released from the TOUCH TO TALK control area, audio from the same door is again received in the headset or handset.

PART 2 PRODUCTS

2.1 ACCEPTABLE SYSTEM CONFIGURATIONS

A. The Security and Control Systems shall be configured to meet the specified Performance, Reliability and Operational requirements.

B. Special Systems Integration- Systems included shall function as an integrated security and control system. This shall be all equipment installed in consoles. Control console shall have a uniform, integrated appearance.

C. Materials- Products to support the systems described in this Section shall be as defined in each Section of Division 28.

D. Comply with requirements of the Contract Drawings.

2.2 SOFTWARE

A. Refer to Specification 28 13 00 for details of the Access Control System software.

PART 3 EXECUTION

3.1 INSTALLATION

A. Provide for system to fully function in compliance with specified system and as recommended by manufacturer of supplied equipment.

B. Comply with accepted submittals that define method of system integration and show outline of functions and sequence of console operator activities.

3.2 ADJUSTING, TESTING AND CLEANING

A. Factory and site test individually and as an integrated system prior to acceptance testing of completed system in presence of Owner. Comply with requirements of Division 28 and system manufacturers for testing systems.

B. All testing and adjusting shall be in compliance with the requirements as listed in Section 28 05 00.

3.3 TRAINING

A. Manufacturers shall be responsible for providing minimum training by authorized system installers/representatives to the Owner’s personnel in compliance with Section 28 05 00.

END OF SECTION 28 05 30

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SECTION 28 06 10 –SECURITY NETWORK EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 0 and Division 1 Specifications, apply to work of this Section.

B. Refer to all contract drawings and specifications listed in Section 28 50 00 for additional requirements.

1.2 SUMMARY

A. The Security Network shall be a complete and fully functional network and cabling system supporting all secure networked-based applications required by the project as described by the Contract Drawings and these Specifications.

B. The Security Network shall provide connectivity and integration of all secure systems including but not limited to: Access Control System, Intercom and Paging, Control Systems, Internal Video Surveillance, and miscellaneous systems as described within the Division 28 specifications and ES Series Contract Documents.

C. The Security Network shall include the following:
   1. New owner provided and configured network switches to be installed by this contractor in equipment rooms as shown on the ES series drawings.
   2. Equipment racks, accessories, and cable tray in MDF and each IDF.
   3. Category-6A, and fiber optic patch panels in the MDF and each IDF.
   4. Fiber optic cabling cabling run from the Main Security Equipment Room to each IDF.
   5. Category-6A cabling from each IDF to each multi-service tele/data communications outlets.
   6. Labeling of all cables, patch panels, racks, and enclosures.
   7. J-hooks and cable tray as required to run cabling concealed above finished ceilings to each outlet.
   8. Rack space for servers and other equipment provided by the Owner.
   9. All patch panels, cables, patch cables, connectors, cable management, and accessories for a complete and fully functional system as intended and described by the Contract Drawings and these Specifications.

D. The Security Network shall be designed to support 1 Gbps Ethernet at the access layer for connected endpoint devices, and 10 Gbps Ethernet at the core layer for uplinks from the access layer network switches.

E. All data cables shall be run in conduit concealed in finished wall or above finished ceilings in resident accessible areas. J-hooks may be utilized in secure spaces that are not inmate accessible.

F. Provide testing, certification, start-up training, and close-out.

G. Coordinate with the Owner for Ethernet Switch programming. LAN configuration shall include, but not be limited to, the following as necessary: IP addressing and DHCP, Virtual Local Area Networks (VLANs), dynamic and static routing, multicast configuration, all necessary security and access configurations, and overall proper connectivity between all devices and network nodes as defined by the Contract Drawings and Specifications. Coordinate with the County, Design Professional and the Using Agency to provide a fully customized configuration that will best serve the needs of the facility.

H. The Contractor shall submit shop drawings, product data, test procedures, test reports, and construction and system schedules to provide complete and functional systems acceptable to the Design Professional and the Owner.

I. The Contractor shall submit port count and bandwidth calculations for each equipment room to the Design Professional and Owner. The Contractor is responsible for providing the Owner with all information necessary for the owner to appropriately procure and configure network switches as required for a fully functional security system.

1.3 COOPERATION WITH OTHER TRADES

A. The Contractor shall coordinate the work of this section as required to ensure that the entire work of this project will be carried out in an orderly, complete, and coordinated fashion.

B. Coordinate installation of power to each equipment rack with the Electrical Contractor.

1.4 INSTALLATION

A. Distribution: Refer to the Contract Drawings for device distribution. Coordinate to provide all outlets necessary to support all IP-based devices as required by the Contract Documents.

1.5 ADDITIONAL REFERENCED STANDARDS

A. ANSI/TIA-568-D-0 (Including all current addenda), Generic Telecommunications Cabling for Customer Premises

B. ANSI/TIA-568-1-D (Including all current addenda), Commercial Building Telecommunications Cabling Standard

C. ANSI/TIA-568-2-D (Including all current addenda), Balanced Twisted-Pair Telecommunications Cabling and Components Standard

D. ANSI/TIA-568-3-D (Including all current addenda), Optical Fiber Cabling Components Standard

E. ANSI/BICSI N1-2019, Standard for Installing Commercial Telecommunications Cabling

F. Building Industry Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (latest edition)

G. Building Industry Consulting Services International (BICSI) Information Transport Systems Installation Manual (latest edition)

H. ANSI/TIA-569-E, Commercial Building Standard for Telecommunications Pathways and Spaces

I. ANSI/TIA-526-14, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant

J. ANSI/TIA-526-7, Optical Power Loss Measurements of Installed Single-Mode Fiber Cable Plant

K. ANSI/TIA-606-A, Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

L. ANSI-J-STD-607-D, Generic Telecommunications Bonding and Grounding for Customer Premises

M. ASTM C636, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

N. IEEE 802.3, Ethernet and all associated applicable standards

PART 2 - PRODUCTS

2.2 OVERVIEW

A. All products listed in this section are the latest generation as of the time of design. The Contractor shall provide the latest generation of each component specified as of the time of product submittal at no additional cost to the Owner

2.3 SECURITY NETWORK ACCESS LAYER SWITCHES

A. The Access Layer Switches for the Security Network will be provided and configured by the Owner. The Contractor shall install access layer switches in equipment racks in the locations identified on the Contract Drawings.

2.4 SECURITY NETWORK CORE LAYER SWITCH

A. The Core Layer Switch for the Security Network will be provided and configured by the Owner. The Contractor shall install core network switches in equipment racks in the locations identified on the Contract Drawings.

2.5 NETWORK FIBER OPTIC CABLE

A. Provide OM4 multimode armored fiber optic cabling for connections between each IDF and the MDF as shown on the Contract Drawings for Security Networks. Provide OS1 single mode armored fiber optic cabling for connections between each IDF and the MDF as shown on the Contract Drawings for Tele/Data Networks.

B. All cable shall be continuous between the terminals with no splicing.

C. The loss of performance of each fiber-terminated connector shall be measured and recorded. The loss shall not exceed the sum of cable and connector losses specified by cable and connector manufacturers +10 percent.

D. Cable shall be riser or plenum rated as required.

E. Multimode fiber optic cable used within the building shall conform to the following specifications as a minimum:

1. 50/125 microns: Stranded Loose tube dielectric - gel-filled cable in damp or wet locations.
2. Fiber Type: Multimode, Graded Index.
3. Operating Wavelengths: 850 nm and 1310 nm.
4. UL/c UL Type OFNP/OFN FT6.
5. Typical Attenuation: Suitable for the application.
6. Bandwidth: Suitable for the application.
7. Operating Temperature: -40°C to +65°C.
8. Connectors: LC

F. Single mode fiber optic cable used within the building shall conform to the following specifications as a minimum:

1. 9/125 microns: Stranded tight buffer.
2. Fiber Type: Single mode
3. Operating Wavelengths: 1310 nm and 1550 nm.

4. UL/c UL Type OFNP/OFN FT6.
5. Typical Attenuation: Suitable for the application.
6. Bandwidth: 1Gbps, 10Gbps, and 40Gbps.
7. Operating Temperature: -40°C to +65°C.
8. Connectors: LC

G. Cable shall be compatible with 1000 Base-SX, 1000 Base-LX, 10G Base-SR, 10G Base-LRM, 40G Base-SR4, and 40G Base-LR4 network standards as required by distance and bandwidth.

H. Cables shall be as manufactured by CommScope, Corning, Siecor, Optical Cable Corporation, Mohawk/CDT, Remee Renfo or Lucent Technologies. FIC shall be configured for termination of the fibers to ensure a reliable, easy to maintain network.

2.6 FIBER OPTIC PATCH PANELS

A. Provide Fiber Optic Patch Panels as required for a complete system as described by the Contract Drawings and Specifications.

B. All fiber connections between communications equipment shall be terminated on Fiber Optic Patch Panels and patched to the equipment using Fiber Optic Patch Cables.

C. Fiber connections on Fiber Optic Patch Panels shall be LC to match all other fiber connector types provided.

D. Signal losses due to all terminations and patch panels shall be taken into account for calculation of signal power. Fiber optic signals shall maintain the manufacturers' required power levels from end to end.

E. Provide modular fiber optic patch panels sized to support at least the quantity of fibers to be provided plus 100% spare.

F. All connectors shall be rated appropriately to support at minimum 10Gbps Ethernet network communications.

G. All fiber optic patch panels shall be fully compatible with the rest of the fiber optic cabling solution so as to be provided with the manufacturer's maximum warranty.

H. Provide rack mounted fiber optic patch panels, modules, and accessories as manufactured by Commscope Systimax G2, Corning, Panduit, or approved equal.

2.7 FIBER OPTIC PATCH CABLES

A. Provide fiber optic patch cables as required for a complete system as described by the Contractor Drawings and Specifications.

B. All fiber optic patch cables shall be fully compatible with the fiber optic cabling so as to provide the manufacturer's maximum warranty.

C. Fiber optic patch cables shall be duplex cables with fiber optic connectors according to the patch panel and equipment connector types.

D. Provide patch cable lengths as required for a neat, organized, workmanlike installation according to the patching and port assignments required by the Owner.

2.8 CATEGORY-6A DISTRIBUTION CABLE

A. Provide Category-6A distribution cable for connecting all field devices and outlets to the nearest associated IDF and as shown on Contract Drawings.

B. Cable shall be Category-6A rated, unshielded twisted pair (UTP) cabling.

C. Cable shall support minimum 1 Gbps and 10 Gbps data communications in compliance with 1000BASE-T and 10GBASE-T standards.

D. All Category-6A distribution cables specific to data and voice outlets and devices shall have a BLUE colored jacket.

E. All Category-6A distribution cables specific to Security devices, excluding cameras, shall have a GREEN colored jacket. Refer to Division 28 for additional details and coordinate with Division 28 Contractor.

F. All Category-6A distribution cables specific to security cameras shall have an ORANGE colored jacket.

G. Cable shall meet or exceed the most current ANSI/EIA/TIA 568 Category-6A standards and shall pass certification testing using the associated approved test limits.

H. Cable shall be listed for riser or plenum use as required. Cables passing between floors without passing through a plenum space shall be at minimum listed for riser use. Cables passing through a plenum space shall be listed for plenum use.

I. Provide Data Network cable manufactured by Commscope, Mohawk, Belden, Panduit, or approved equal.

2.9 CATEGORY-6A PATCH PANELS

A. Provide Category-6A rated patch panels for a complete system as described by the Contract Drawings and Specifications.

B. Patch panels shall have mounting tabs for mounting on standard 19” rack.

C. Patch panels shall be available in minimum 48 port configuration.

D. Category-6A patch panels shall be as manufactured by Commscope, Panduit, Hubbell, Leviton, Siemon, Ortronics, or approved equal.

E. Patch panels shall be as manufactured by the same manufacturer as the Category-6A distribution cable, or the patch panel manufacturer shall have a mutual agreement with the Category-6A distribution cable manufacturer for fully compatible and warranted structured cabling systems.

2.10 CATEGORY-6A PATCH CABLES

A. Provide patch cables for all necessary patching in all equipment rooms.

B. Patch cable jacket colors shall match the corresponding Category-6A distribution cable jacket color.

C. Patch cables shall be provided from the same manufacturer as the Category-6A distribution cable and be fully compatible so as to qualify for the manufacturer’s maximum cabling warranty.

D. Provide patch cable lengths as required for a neat, organized, workmanlike installation according to the patching and port assignments required by the Owner.

1. For each patch panel termination in the IDF, provide one (1) 7-foot patch cable matching the jacket color of the associated distribution/horizontal cabling.
2. For each tele/data field outlet jack, provide one (1) 10-foot patch cable matching the jacket color of the associated distribution/horizontal cabling.
3. For each WAP location which is provided with a WAP enclosure, provide one (1) minimum 3-foot patch cable matching the jacket color of the associated distribution/horizontal cabling, or longer length as required to reach from the outlet location to the WAP location.

2.11 CABLE TRAY

A. Provide ladder-type cable tray as shown on the Contract Drawings.

B. Cable tray shall be suspended from the structural ceiling. Provide appropriate mounting hardware and all accessories as required to properly support the cable tray, all cabling to be provided, plus 150% spare cabling capacity.

C. Provide ladder sections, joints, and all accessories as required for a complete and continuous cable tray system.

D. Cable tray shall be a minimum of 18" wide with minimum 9" rung spacing. Side rails shall be minimum 4" tall or as required to accommodate cabling to be provided plus 150% capacity.

E. All edges shall be rounded and all surfaces shall be smoothed to prevent damage to cabling.

F. Provide cable management accessories including but not limited to waterfalls and radial horizontal corners to maintain minimum cable bend radii and all other cabling manufacturers' requirements.

G. Provide ladder-type cable tray as manufactured by Cooper B-Line, Chatsworth Products, or approved equal.

2.12 TELE/DATA COMMUNICATIONS TERMINATION OUTLETS AND FACEPLATES

A. Provide modular 1-gang outlets at all network outlet locations required for equipment connections indicated on the Contract Drawings. Provide proper faceplates to support required services at the locations indicated.

B. For security devices which are installed surface- or flush-mounted, provide a surface mounted RJ45 outlet box above the ceiling or behind the wall with patch cord to the device.

C. Outlets shall utilize modular "snap-in" type communications connector design.

D. Provide RJ45-type Category 6A-rated modular jacks for all network terminations. Jacks shall be the same color as their associated wiring.

E. All outlets shall follow TIA/EIA 568-B configuration standard.

F. Faceplates shall allow for up to six (6) modular RJ45 or RJ11 jacks.

G. All faceplates shall be stainless steel, with label fields. The Contractor shall coordinate the faceplate color with the Owner. Electrical and communications faceplates must match. Coordinate outlet labeling with the Design Professional and the County.

H. Provide faceplates and modular “snap-in” tele/data communications connectors from the same manufacture. Faceplates shall be Hubbell, Leviton, Seimon, Ortronics, or approved equal.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION WORK

A. The Contractor shall examine the conditions under which the system installation is to be performed and notify the Design Professional in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.

B. Prior to the start of installation, meet at the project site with all trades involved to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout, wall layout, and other work which penetrates or is supported throughout the space of the building. All work shall be flush/semi-flush and workmanlike in all finished areas.

3.2 INSTALLATION

A. Contractor shall install Security Network Switches procured and configured by the Owner.

B. Contractor shall be certified by the manufacturers prior to installation of communications equipment and cabling. Technicians shall have successfully completed all necessary training for certification.

C. All cables shall be installed to the EIA/TIA-568B wiring scheme.

D. Install materials and equipment in accordance with manufacturer's printed instructions to comply with governing regulations and industry standards applicable to the work and as shown on approved shop drawings.

E. Installation shall be in accordance with EIA/TIA-569 “Pathways”.

F. Arrange and flush-mount all equipment and materials in a manner acceptable to the Owner and Design Professional.

G. Minimal allowable bend radius of all conduits and raceways shall be 6”. LB type conduit outlet bodies shall not be permitted.

3.3 TESTING

A. Refer to Specifications section 271000 Structured Cabling for cable testing requirements.

3.4 WARRANTY

A. The contractor shall provide the manufacturer’s 20-year warranty for the Security Network structured cabling system covering cable, connectivity, and labor for the material and manufacturing workmanship. Warranty shall include applications assurance including but not limited to Gigabit Ethernet.

B. Refer to Section 28 05 00 for additional Warranty requirements.

3.5 COMPLETION OF WORK

A. The Contractor shall be required to verify the following:
   1. Pull ropes are provided and maintained in all conduits.
   2. All fastenings are properly secured.
   3. Clear and unobstructed infrastructure pathways are provided which in no way limits the contractors from cabling the entire site in a safe, secure, and workman-like manner.
   4. Clean all equipment of construction debris and dust and leave equipment in a "like-new" condition.

END OF SECTION 28 06 10

SECTION 28 13 00 - SECURITY ACCESS CONTROL SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the contract, including the General and Supplementary Conditions apply to this Section.

B. Refer to all Contract Drawings and specification sections listed in Section 28 05 00 for additional requirements.

1.2 SYSTEM DESCRIPTION

A. Control Access to selected areas using proximity access control cards.
   1. Selected Staff Access Exterior Doors: Control access into building at locations as shown on drawings.
   2. Selected Staff Access Interior Doors: Control access into areas as shown on drawings.
   3. Guard Tour Function: Allow designated card readers to function as a Guard Tour station where officer's on-duty can utilize their Access Control Card and acknowledge they were in a specific location by presenting the Access Control Card to the designated card reader as shown on the Contract Drawings

B. Restrict Access of individual cardholders by time of day, day of week and specific points of entry via system software.

C. Monitor Points in building and selected areas as shown on drawings that provide unauthorized access or egress and may be a point for forced entry. The system shall report changes in status for all monitored points indicating the specific location so the operator can respond appropriately.
   1. Selected Exterior Perimeter and Internal Points: Provide four-state supervised inputs to system for monitoring the status of doors.
   2. Furnish Intrusion Detection Devices under provisions in this specification.

D. Provide Video Monitoring of doors and alarms when access is requested or a door is opened. This is provided by connection between the Access Control System, PLC Control System, and Video Surveillance System.

E. System Workstation shall be integrated into the Central Control Center Touchscreen Computer (TSC) System. It shall show status of all card reader controlled doors on the Central Control Center (CCC) TSC graphical screens. It shall provide a real-time display of all system events, archive all events in a history file on the hard disk, and serve as the instrument through which all system programming is accomplished. Personal computer

shall be configured for the intended system function by loading the appropriate services and operating system software.

1. Access System Computer: shall be installed in location determined by the Owner and shall run the system database service for interfacing with the TSC/PLC control system for polling and communicating with the card readers, a user interface for monitoring system activity and database administration. The system server shall have the operating system for the access control software function installed. All pertinent access control shall be integrated into the Central Control Center's Touchscreen Computer System. Lock control shall be through the PLC and the associated interfacing relays.

F. Provide monitoring of selected doors as shown on the Contract Drawings. Coordinate with the door hardware provider.

G. Provide interfacing to Fire Alarm System for automatic release/unlocking of selected doors in the path of egress upon fire alarm in non-detention areas.

H. Provide all necessary programming for a fully functional Access Control System.

I. Provide interface to Video Surveillance System for Video – Follow – Alarm.

J. Provide Guard Tour system programming utilizing Access Control System. Provide new card readers, proximity cards, and programming to allow Guard Tours of the facility. Refer to Contract Documents for Access Control System locations.

K. Provide 200 Access Control proximity cards for staff.

L. Provide report generation for all alarm signals.

M. Provide card access proximity card printing including digital picture. Coordinate the location of the badging station with the Owner.

N. Provide all power supplies for access control equipment and door locks. All access control systems including card readers, computer systems, and door lock power supplies shall have battery backup UPS power.

1.3 GENERALIZED DESCRIPTION OF WORK

A. Provide Access Control System including system software residing on control system computers, controllers, card readers, PLC interfaces, cards, and badging station.

B. Interface to PLC system for electric lock control.

C. Interface to PLC system for monitoring magnetic door switches.

D. Provide all required power supplies. Coordinate with the Electrical Contractor.

E. Provide all cabling connections required.

F. Coordinate with the Electrical Contractor all conduit requirements.

G. Coordinate with door hardware and door supplier.

1.4 RELATED WORK

A. In addition to work described above under DESCRIPTION OF WORK, the work shall include, but not necessarily be limited to, the following:
   1. Rigging of equipment and materials including all miscellaneous steel and hangers for support of all installed equipment.
   2. Assembly of all equipment furnished disassembled.
   3. Testing and start-up of all equipment supplied.
   4. Cleaning of all apparatus specified elsewhere.
   5. Equipment identification as specified herein and elsewhere.

PART 2 PRODUCTS

2.1 OVERVIEW

A. The products specified herein were the latest generation at the time of specification and provide the functionality and intent of the system requirements. The Contractor shall provide, at the time of product submittal, the manufacturers latest generation of products, hardware and software, with equal or greater functionality.

B. The devices described herein are intended to provide a reference for the Card Access / Security System, and are to be provided as described in the Contract Documents.

C. All system components shall be approved for the function they will perform.

2.2 MANUFACTURERS

A. Access Control Panels and Software: shall be manufactured by Software House, no approved equal.

B. Card readers and access cards shall be manufactured by HID Corporation, Software House, or approved equal.

C. Computers for Access Control System: shall be manufactured by Dell.

D. Monitors for Access Control Computer: shall be manufactured by Planar, LG, or approved equal.

E. Door Release Pushbutton: shall be manufactured by Quam, or approved equal.

2.3 DATABASE

A. The system shall be of an open architecture design and shall support industry standard databases such as Microsoft SQL Server, Oracle Server, IBM DB2, or MSDE database.

B. The database shall reside on the system server at Central Control for district wide database services, system programming, system monitoring, administrative services, report, and proximity card generation.

C. The system shall be capable of utilizing a true client/server network configured to support the system database service, all services and user interfaces optimizing the users' options for system programming, event monitoring, and record keeping.

2.4 SYSTEM SOFTWARE

A. Software Capacities:
1. System software and language development software shall be existing, industry-standard, and of a type widely used in institutional systems. Operating system shall be multi-user/ multi-tasking capable of operating on a non-proprietary CPU. The application software, substantially as offered, shall be written in a high level, industry standard programming language. The system shall be modular in nature, allowing the system capacities to be easily expanded without requiring major changes to the system operation and maintaining all defined system data as well as historical information.
2. All System functions shall be accessible via point and click mouse control. Systems requiring command string control or complex syntax are not acceptable. The system software shall include the following features and be configured for a minimum:
    a. (256) readers.
    b. (10,000) active cardholder records.
    c. (4) Simultaneous client PC licenses.
    d. (32) Programmable holidays.
    e. Number of assets = 40,000.
    f. (2000) clearance codes.
    g. Operator accounts with unlimited definable privilege levels.

h. Audible alarm annunciation at operator workstation.
i. Unlimited graphic maps to be displayed on the operator workstation monitor.
j. Remote network diagnostics.
k. Event scheduling.
l. An unlimited number of user defined card holder data fields.
m. An unlimited number of door groups.
n. An unlimited number of areas.
o. Cardholder access privilege activation date and time.
p. Cardholder access privilege expiration date and time.
q. Americans with Disabilities Act (ADA) compliance in door and access operation.
r. Interface and integration with Video Surveillance System.
s. Field panel communications through various means including hardwired Ethernet network.

B. Software Operation:
1. The system shall provide a top-down configuration methodology. Top-down programming shall allow the system operator to configure the system software and hardware configurations in a logical flowing method. The system should allow the operator to start at the highest configuration level of the system, and then move down through the lower configuration levels without having to move back and forth between a variety of menus.
2. Where the operator may be presented with a choice of pre-defined objects, the system shall provide a pop-up pick list. The operator may choose an object in the listing by clicking on the item. If the object has not been pre-defined, the operator may define the new object from the pop-up pick list.
3. The system shall utilize dynamic icons. The dynamic icons shall change appearance, in both color and icon display based upon the status of the associated object. This appearance change shall occur in real time and shall not require the system operator to perform a screen refresh or exit the current screen.
4. Dynamic icons shall be provided to represent:
a. Intelligent field panels.
b. Door lock control.
c. Cameras and domes.
d. Alarm input.
e. Output control relay.
f. System/alarm event.
g. Manual operator actions.
5. For intelligent field panels hard wired to the host computer, the dynamic icons shall reflect the true state of the device represented by the icon. For example, if an

operator issues a command to unlock a door, and the field panel which controls that door is not in communication with the host computer, the icon shall not change state or appearance.

6. Where certain data fields within data screens may contain the same information, the system shall provide the ability to define default settings for these data entry fields. The operator shall be able to change the default setting without impacting objects that have already been defined.
7. Open Database Connectivity: The Security Management Control System shall utilize a database engine which is Open Database Connectivity (ODBC) compliant. This database engine shall be compatible with 32-bit ODBC drivers. The system shall allow the ability to perform ODBC writes to the system database to import personnel data directly into that database. This data shall then be automatically downloaded to field devices in the same way as manually entered information.
8. The software manuals for the Security Management Control System shall provide complete documentation outlining the database schema used within the system. This documentation should be sufficient to allow a person, moderately skilled in databases, to extract information from the Security Management Control System's databases. The database schema information shall include information on the personnel tables, history and configuration tables.
9. It shall be possible to use third party report tools, such as Crystal Reports, to generate reports not already provided by the Security Management Control Systems, such as statistical or graphical reports of system activity.
10. ODBC password protection: Database level Username and Password protection shall be provided for ODBC users. ODBC users will be required to supply a Username and Password when they connect to the SMCS database. Usernames and passwords shall be configured via the user configuration functionality currently available in the Administration utility.
11. Date format: The system shall support the date being formatted in DD/MM/YY or MM/DD/YY, depending upon local date formatting.
12. Card reader LCD panels: The system administrator shall be able to define the language and date format that shall be used for display of messages on reader LCD panels.

C. The access control system software shall be by Software House C-Cure, no approved equal.

2.5 CARD READER

A. Provide for all staff doors as outlined on the Contract Drawings, high-security vandal-proof proximity card readers. It shall meet the following requirements:
   1. It shall be vandal-resistant.
   2. It shall be compatible with HID Seos card technology.
   3. It shall feature indelible graphics and labeling.
   4. It shall mount to standard electrical backboxes (single gang).

5. All mounting hardware shall be tamperproof, center-pin torx head hardware (six-lobe).
6. A Lifetime warranty shall be provided.

B. Provide proximity card readers shall comply with UL-294 standards.

C. The reader shall work with passive proximity cards. A red LED shall indicate power to the reader. When a proximity card is presented to the reader, the red LED shall flash green and the beeper shall sound briefly indicating to the cardholder that the card was read. A longer duration flash and beep shall follow for an authorized card. On reader power-up, an internal self-test routine shall check and verify the setup configuration, determine the internal or external control of the LED and beeper and initialize the reader operation.

D. Card reader shall be HID Signo 40, or approved equal. For locations requiring narrow reader, shall be HID Signo 20, or approved equal.

2.6 ACCESS CARD REQUIREMENTS

A. The Vendor shall be responsible for providing a cross-reference list showing the serial number and the embedded number for each card.

B. Each card shall have a return address if found.

C. Each card shall have, preprinted by the factory, one side of the card. The preprinted information could contain company logo, building façade, return address, or any color graphic as directed by the Owner. The manufacturer shall display different designs to assist the Owner with choice.

D. Contractor shall provide two hundred (200) blank cards.

E. Access cards shall be Seos as manufactured by HID or approved equal

2.7 ALLOWABLE CARD ACCESS TIME LIMITS

A. Under all conditions, maximum access time shall be 0.75 seconds.

B. Maximum allowable access time is defined as the time period starting with presentation of card to reader (completed read cycle) and ending with complete actuation of door release module (or relay as applicable). It does not include the mechanical time inherent to the unlocking mechanism.

2.8 DOOR POSITION SWITCHES

A. The door hardware supplier shall provide concealed, biased, door position sensors for all doors that require monitoring as shown on the Contract Drawings.

B. Recessed magnetic door contacts shall be installed by the door and hatch hardware supplier on all doors as defined in the contract drawings.

C. Each magnetic door contact shall be configured by the Contractor as a separated alarm point.

D. All magnetic door switches shall be wired, connected, and tested by the Contractor.

E. Coordinate with the door hardware suppliers.

F. If in a unique or difficult situation and a recessed magnetic door contact is not feasible, then a surface mount contact may be substituted if it meets the requirements of a high security biased switch configuration with concealed terminals, aluminum housing and armored cable.

G. Any doors found not already prepped to receive the recessed door contact shall be so fitted on site as part of this contract.

2.9 REQUEST-TO-EXIT (REX)

A. Coordinate with door hardware supplier.

2.10 DOOR RELEASE PUSHBUTTON

A. Provide a single-gang, vandal resistant call-in switch with momentary push-to-call button stainless steel door release.

B. Provide etched labeling on pushbutton faceplate as approved by Owner.

C. The door release pushbutton shall be the CIB-2 Quam Push Button.

2.11 SECURITY DOOR HARDWARE

A. As outlined in the Door Hardware Schedule in the Architectural Specifications.

PART 3 EXECUTION

3.1 INSPECTION AND PREPARATION WORK

A. This Contractor must examine the conditions under which the system installation is to be performed and notify the Owner’s Representative or Design Professional in writing of

unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.

B. Review all areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout and wall layout and other work that penetrates or is supported throughout the space of the building. All work shall be flush and workmanlike in all finished areas.

3.2 INSTALLATION

A. Install materials and equipment in accordance with manufacturer's printed instructions to comply with governing regulations and industry standards applicable to the work and as shown on approved Shop Drawings.

B. Arrange and mount all equipment and materials in a manner acceptable to the Design Professional and Owner.

C. Coordinate with the Owner all programming for access control privileges, control restriction, normal operations, off hours and holiday schedules, report generation, badging configuration and information and pin number generation before Final Acceptance. Make minor adjustments at no cost to the Owner during the warranty period's two routine inspection periods as outlined in Section 280500.

D. Installation shall conform to the basic guidelines:
1. Use of approved wire, cable, raceways, wiring, devices, hangers, supports, and fastening devices.
2. Separation of high and low voltage wiring is required throughout the installation.
3. All wiring shall be thoroughly tested for grounds and opens before final connection.

E. Conduit shall be provided for risers. Horizontal wiring shall run without conduit unless required by code, see - QUALITY ASSURANCE. All power wiring shall be in metallic conduit. The maximum conduit fill shall not exceed 40% of rated capacity. Refer to NFPA 70-NEC for additional requirements.

F. Cabling and Wire Requirements:
1. Refer to Section 280500 for all raceway, surge, and wiring requirements.
2. The individual systems low voltage cabling shall use separate conduit/raceway junction boxes and enclosures, then electric power cabling.
3. The minimum low voltage input/output cabling for Access Control System shall be #18 AWG unless specifically specified on the Contract Drawings. Provide minimum 3 pair, twisted, individually shielded pair type cabling for card readers and keypads. All cabling shall be jacketed. The systems cabling shall meet the requirements of NFPA 70/NEC Articles 725, 760 and 800 as applicable for each type of system specified.

4. The minimum bend radius of all conduits provided by others is 6 inches. Provide and maintain pull strings/tapes/ropes in all conduits for future installation of additional cabling.
5. All pull strings installed or placed in conduits that already contain, or that will contain system cabling, shall be able to be removed from the conduit without causing any damage to the cabling already contained with same conduit(s).

G. Junction Boxes, Enclosures/Cabinets, Equipment Racks:
1. The equipment enclosures shall be installed at approved locations and be typically ventilated as required to maintain the environmental conditions specified by the electronic equipment manufacturers.
2. All junction boxes and pull boxes shall be labeled. The box label shall state the system and use of cabling. The labeling shall be made with markers which are indelible when and after in contact with water and oil.
3. Each box and enclosure shall contain a cabling and wiring log identifying all cabling accessible whether it is connected or is passing by.
4. Refer to other sections of this Specification for additional requirements.

H. Grounding and Surge Protection:
1. Provide single point grounding of the individual systems as recommended by IEEE and system manufacturers. Provide all cabling, bonding and insulation materials as required. Provide surge protection and clamping for all circuits. Coordinate all grounding, surge protection, and manufacturers.
2. Coordinate grounding requirements with other trades and contractors to preclude closing of ground loops via peripheral equipment supplied from different electrical power sources. Provide isolation transformers and other equipment as required.

3.3 SPECIAL TOOLS, EQUIPMENT AND MATERIALS

A. The Contractor shall deliver to the Owner’s Representative all special tools, equipment, and materials necessary to maintain the system provided under this Contract.

3.4 ADJUSTING, TESTING AND CLEANING

A. Contractor shall be required to perform complete testing and verification of the following:
1. Card reader maximum access time shall be 0.75 seconds under all system loads.

B. Refer to Section 28 05 10 for additional requirements.

3.5 AS-BUILTS

A. Refer to Section 28 05 10.

3.6 SUBMITTALS

A. Refer to Sections 28 05 00 and 28 05 10.

3.7 TRAINING

A. Refer to Section 28 05 10.

END OF SECTION 28 13 00

SECTION 28 17 00 - WIRED DURESS SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The specifications section “General Conditions”, “Special Requirements” and “General Requirements” form a part of this section by this reference thereto and shall have the same force and effect as if printed herewith in full.

B. The Drawings and General Provisions of the contract, including the General and Supplementary Conditions and Division 28 specification Sections apply to this Section.

1.2 SUMMARY

A. The Drawings and General Provisions of the contract, including the General and Supplementary Conditions and Division 28 specification Sections apply to this Section.

B. Provide hardwired duress pushbuttons at locations outlined on Contract Drawings.

C. Integrate the wired duress pushbuttons with the Access Control System.

1.3 QUALITY ASSURANCE

A. All components of system shall be manufactured by a single manufacturer who has specialized in the design and manufacturer of detention-grade duress systems for at least five (5) years.

1.4 WARRANTY

A. All parts and labor: Two (2) years.

PART 2 - PRODUCTS

2.1 OVERVIEW

A. The equipment described herein is intended to provide a reference for the Staff Duress System, and is to be provided as shown on the Contract Drawings.

B. Provide all materials, labor, equipment and services necessary to provide a complete Hard Wired Staff Duress System.

C. All system components shall be approved for the function they will perform. Devices that require modification for these applications will not be approved.

2.2 WIRED DURESS ALARMS OPERATIONS

A. Alarms displayed on ACS/TSC screens;

B. Audio Signal of alarm zone annunciation transmitted to Fire Alarm Paging system for select paging. Alarm names shall be custom programmed and shall be coordinated with the Using Agency.

2.3 DEVICE POWER SUPPLIES

A. The Contractor shall provide all necessary regulated power supplies designed and sized to meet all the duress manufacturer's device requirements. All power shall be sized with 50% additional ampacity above the actual equipment loads being powered by the supplies.

B. All power supplies shall be UL-listed.

2.4 HARDWIRED DURESS BUTTON AND LIGHT

A. Provide duress switches as outlined on contract drawings with latching key reset button switches, with red mushroom button mounted on stainless steel single gang plate, with key reset cylinder.

B. Duress/Panic Alarm call-in switch shall be flush in all finished areas or surface (if unfinished area) mounted security type installed as shown on the drawings. Switch shall be momentary contact type. Switch assembly shall be Heavy Duty, maximum security, vandalproof, pushbutton and keyswitch.

C. All system components including controls shall be documented with Mean Time Before/Between Failure (MTBF) of minimum 100,000 hours.

D. All equipment, materials, appurtenances, and work shall meet the maximum security vandalproof and MTBF requirements specified.

E. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Dortronics
   2. Assa Abloy
   3. SDC
   4. Or approved equal

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall install staff duress system components.

B. All wiring and cabling shall be in conduits. Refer to other Division 26 and 28 specifications for conduit requirements.

C. Provide systems integration as required to implement all performance and operational requirements specified.

D. Use of power circuit wiring as a carrier/data communication cable is not permitted. Provide dedicated circuit paths only.

E. All equipment shall be installed by factory trained and certified installers.

F. Provide all certification forms fully completed and signed by the Contractor.

3.2 FIELD QUALITY CONTROL

A. Contractor shall inspect and test the installation and operation of the system completely prior to acceptance tests.

B. All test results shall be compiled in a typed report signed by the Contractor personnel performing the test.

3.3 ACCEPTANCE TEST

A. Acceptance tests shall be conducted by the Contractor and Owner to ensure compliance with plans and specifications.

END OF SECTION 28 17 00

SECTION 28 23 00 - VIDEO SURVEILLANCE SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Conditions of the Contract, including the General and Supplementary Conditions and Division 28 Specification Sections apply to this Section.

B. Refer to Contract Drawings and Specifications listed in Section 28 05 00, for additional requirements.

1.2 SITE WORK

A. Site work shall be coordinated with all trades having related work on site including general, building, structural, civil, site, landscape, mechanical, electrical and others.

B. Careful planning must be implemented to achieve full, maximum security at the site after construction with no lapses at any location.

C. The work includes full certification and testing of the system prior to placement into commission.

1.3 DESCRIPTION OF WORK

A. Provide materials, labor, equipment and service necessary for a complete IP-based Video Surveillance system (VSS) as described herein including: cameras, housings, mounts, cables, monitors, fiber optic interference cabinets, Ethernet switches, video management servers, network video recorders and appurtenances. Provide video surveillance with field of view as shown on Contract Drawings.

B. Provide transmission of the IP video and Video Surveillance System keyboard signals to the Control Center Equipment Room for interior cameras and for the perimeter exterior cameras. All exterior cameras shall include fiber optic interface cabinets, fiber optic transmitters and receivers as required. Provide min. fiber optic cables for video and two (2) fiber optic cables for keyboard/spare, and required fiber optic transceivers installed in interface cabinets. All interior cameras shall include IP video and control over CAT-6A cable.

C. The Contractor shall provide any additional VSS control keyboard control cabling from the fiber optic interface cabinet to the Central Control Center Electronics Equipment Room required for remote control by Control Center equipment.

D. Refer to the VSS product paragraph for information on cameras, lenses, and mounting. Camera aim, adjusting and exact mounting location are the responsibility of the Contractor. The Contractor shall provide complete surveillance of the areas shown on the "ES" Contract Drawings.

E. Contractor shall demonstrate camera views to Using Agency prior to permanent mounting for all cameras using 20" demonstration monitor and recommended camera/lens coordination.

F. Color video surveillance cameras shall be provided at all doors, gates, dayroom spaces, gym, dining area, and corridors controlled from a remote location such as control centers and stations as indicated on Contract Drawings. The resolution of the fixed cameras shall provide for facial recognition for above-mentioned interior spaces.

G. Lens combinations are recommendations only. Final selection of lenses shall be closely coordinated based on desired camera views. Contractor shall provide lenses to cameras that provide views approved by Using Agency.

H. Cameras shall be provided for remote observations of critical points.

I. The cameras requiring non-integrated housings shall be mounted in chromatically flat, optically correct, maximum-security, vandalproof, and environmental housings.

J. The lighting levels shall be minimum 0.5-foot candles with uniform distribution and smooth transitions at building entry and exit points.

K. Video surveillance monitors shall be provided at all locations indicated on the Contract Drawings.

L. Video surveillance monitors shall be provided at all locations indicated on the Contract Drawings. Provide video surveillance monitor mounting system including all mounting hardware.

M. All interior cameras shall be displayed for cursory review by the Central Control Room operator. Cursory review shall be defined as multiplexed/split screen display (cameras/monitor) and sequential display for all video surveillance cameras. Active scenes with entry/exit or other critical events shall be displayed on dedicated call-up monitors for the operator to focus on events which require his/her acknowledgment and decision. The perimeter video signals shall also be transmitted to the headend system for display and recording.

N. Typically, the call-up functions shall be initiated through interfacing of video management system with intercoms, card readers, and other systems described in these specifications. In addition, the Contractor shall provide video motion detection functions for all cameras to activate the above-described call-up functions associated with critical events and areas such as intrusion/unauthorized access.

O. Provide all Ethernet switches and proper fiber optic modules for transmission of the IP video signals from the cameras to the Central Control Room for viewing, and to Main Equipment Room for recording.

P. All cameras shall be recorded digitally on a Network Video Recording System. Provide complete video recording systems in Equipment Room, review console, patch capability, PTZ keyboard, and other equipment shown on Contract Drawings.

1.4 SYSTEM DESCRIPTION

A. The video surveillance system shall display all cameras on video monitors installed at locations indicated on Contract Drawings.

B. Video Signals from cameras shall be processed by the Video Management System to provide for simultaneous recording and display of all cameras.

C. All video surveillance cameras shall be recorded digitally for a minimum of 30 days of First in First Out (FIFO) recording/storage, at full resolution, at a minimum of 15 frames per second (fps) and on alarm or motion at full framerate.

D. The video surveillance, digital recording, and required associated equipment shall connect, communicate, and integrate with the access control system to provide camera call-up and alarm recording as required elsewhere within these specifications. The contractor is to provide all associated equipment required to provide such functionally.

E. All cameras shall be able to be displayed on the monitors located in Central Control Room.

F. Recorded video playback system shall be provided at a video surveillance workstation dedicated to internal review and export by limited personnel. Video playback and export shall not be possible for users at live viewing stations. Coordinate personnel access requirements with the Owner.

G. Mount interior cameras in either ceiling and/or corner mount camera housings as indicated on the Contract Drawings. All exterior cameras shall be mounted in security grade, weatherproof, heated housings at a minimum height of 12 feet.

1.5 REFERENCE STANDARDS AND CODES

A. National Electrical Code (NEC).

B. Underwriters Laboratory (UL).

C. Section 28 05 00 list of Codes and Standards.

1.6 COOPERATION WITH OTHER TRADES

A. The Contractor shall coordinate the Work of this Section as required to ensure that the entire Work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.7 SUBMITTALS

A. General Requirements:

1. Submittals shall be made in accordance with SPECIAL REQUIREMENTS FOR SECURITY AND COMMUNICATIONS SYSTEMS. Refer to Sections 28 05 00 and 28 05 10 for requirements.

B. Specific Requirements:

1. Submit catalog cuts for each piece of equipment.
2. Submit plan drawings showing location, mounting and field of view of each camera.
3. Submit point-to-point wiring diagram for VSS including grounding of all system components.

1.8 RELIABILITY

A. All VSS components shall have mean time before/between failure of minimum 36,000 hours.

PART 2 PRODUCTS

2.1 OVERVIEW

A. The devices described herein are intended to provide a reference to the Video Surveillance System, and are to be installed as shown on the Contract Drawings.

B. Certain devices described may not be applicable to all systems. All devices required to complete the installation may not be described. It is the responsibility of the Contractor to provide a complete working system.

C. All system components shall be approved for the function they will perform. Devices that must be modified or are not UL-listed will not be approved.

2.2 2MP IP FIXED CAMERAS

A. Provide fixed IP vandal resistant cameras for internal and exterior mounting locations with the following characteristics or features:

1. Resolution: 1920x1080
2. Rating: IK10, IP67
3. Image Sensor: Approx. 1/2.8 type CMOS
4. Power: Power over Ethernet+ (PoE)
5. Dynamic Range: Max. 126 dB
6. Compression: H.265/H.264
7. Frame Rate: 60fps at all resolutions
8. Exterior rating: IK10 vandal resistant rating enclosure.

B. IP Cameras shall be manufactured by Avigilon model series 2.0C-H6A.

2.3 6MP IP FIXED CAMERAS

A. Provide fixed IP vandal resistant cameras for internal and exterior mounting locations with the following characteristics or features:

1. Resolution: 3328x1872
2. Rating: IK10, IP67
3. Image Sensor: Approx. 1/1.8 type CMOS
4. Power: Power over Ethernet+ (PoE+)
5. Dynamic Range: Max. 130 dB
6. Compression: H.265/H.264
7. Frame Rate: 30fps at all resolutions
8. Exterior rating: IP66, IK10 vandal resistant rating enclosure.

B. IP Cameras shall be manufactured by Avigilon model series 6.0C-H6A.

2.4 8MP IP 360 CAMERAS

A. Provide fixed IP vandal resistant cameras for both internal and external mounting locations with the following characteristics or features:

1. Resolution: 2048×2048
2. Rating: IK10, IP66
3. Image Sensor: Approx. 1/1.8 type CMOS
4. Power: Power over Ethernet (PoE)
5. Dynamic Range: Max.120 dB
6. Compression: H.265/H.264
7. Frame Rate: 30fps at all resolutions
8. Exterior rating: IP66, IK10 vandal resistant rating enclosure.

B. IP Cameras shall be manufactured by Avigilon model series 8.0C-H6A-FE.

2.5 12MP IP 360 CAMERAS

A. Provide fixed IP vandal resistant cameras for both internal and external mounting locations with the following characteristics or features:

1. Resolution: 3520×3520

2. Rating: IK10, IP66

3. Image Sensor: Approx. 1/1.6 type CMOS

4. Power: Power over Ethernet (PoE)

5. Dynamic Range: Max.120 dB

6. Compression: H.265/H.264

7. Frame Rate: 30fps at all resolutions

8. Exterior rating: IP66, IK10 vandal resistant rating enclosure.

B. IP Cameras shall be manufactured by Avigilon model 12.0C-H6A-FE.

2.6 4 X 5MP IP MULTI IMAGER CAMERAS

A. Provide fixed IP vandal resistant cameras for both internal and external mounting locations with the following characteristics or features:

1. Resolution: 2560 x 1440 per sensor

2. Rating: IK10, IP67

3. Image Sensor: 4 x 1/2.8 type CMOS

4. Power: Power over Ethernet+ (PoE+)

5. Dynamic Range: Max. 120 dB

6. Compression: H.265/ H.264

7. Frame Rate: 30fps at all resolutions

8. Exterior rating: IP66, IK10 vandal resistant rating enclosure.

B. IP Cameras shall be manufactured by Avigilon model 20C-H5A-4MH-DP1.

2.7 LENSES

A. Lens focal lengths shall be selected as required for field of view as directed by Owner.

2.8 LED VIDEO MONITORS

A. 27” LED Video Monitor:

1. Provide high resolution, 27” LED color video monitors as shown on the contract drawings with the following characteristics or features:

a. HDMI or DisplayPort Input or appropriate interface converter.

b. Aspect Ratio: 16:9.

c. Resolution: 1080P (1920 x 1080).

d. Brightness: 250 cd/m2.

e. Contrast Ratio: 1000:1.

f. Viewing Angle: 170° H/160° V.

g. Rated for 24/7 operation.

2. 27” LED color video monitors shall be manufactured by Planar, LG, or approved equal.

B. Overhead LCD Video Monitor:

1. Provide 43” or 55” overhead LCD video monitors as shown on the contract drawings with the following characteristics or features:

a. HDMI input: Provide appropriate interface converter as required.

b. Aspect Ratio: 16:9.

c. Resolution: 4K (3840 x 2160).

d. Brightness: 350 cd/m2.

e. Contrast Ratio: 3000:1.

f. Viewing Angle: 178° H/178° V.

g. Rated for 24/7 operation.

h. LCD monitors shall be wall mounted or pole mounted from ceiling.

2. Overhead LCD video monitors shall be manufactured by Planar, LG, Panasonic, or approved equal.

C. Wall mount shall be as manufactured by Peerless, Chief, or approved equal.

D. Pole mount shall be as manufactured by Peerless Chief, or approved equal. Provide all required mounting plates, anchoring points, hardware, and accessories required to mount from ceiling in each location.

2.9 IP VIDEO SURVEILLANCE MANAGEMENT, RECORDING, AND VIEWING SYSTEM

A. The IP Video Surveillance Management, Recording, and viewing system shall be a combined software and hardware system. The system shall include all Servers, Computers, Network equipment and accessories required to for a fully functional IP-based Video Surveillance system.

B. The system shall provide recording of all Video Surveillance IP cameras on network server or storage space.

C. The system shall provide viewing of live and recorded video on network workstations as shown on the construction documents.

D. The system shall be designed to meet the Video Surveillance application of the Owner's security system.

E. The System shall provide all common function of a matrix switch based Video Surveillance system.

F. The Contractor shall provide all required Video Surveillance equipment, network equipment, modules, power supplies, wiring, relays, etc., whether listed herein or not, to provide a perfectly operational system with no glitches, bugs or impediments which would otherwise detract from proper system operation. Contractor shall inform himself through thorough investigation of Manufacturer and meet all Video Surveillance Monitoring, Management and Recording requirements as required by Design Professional and Owner.

G. Provide an IP Video Surveillance Video Management, Recording, and Viewing System shown on the Contract Drawings having the following features/characteristics:

1. IP Video Surveillance System Performance Requirements:

a. The system shall simultaneously provide the following feature on all servers and network workstation without any video quality degradation and loss of frames:

1) Video recording.

2) Video Playback.

3) Live video Display.

4) Multi-screen (multiplexed) Live Video Display.

5) System/ Camera Configuration Adjustments.

6) Camera Selection.

7) PTZ camera Control.

b. Image Quality:

1) The system shall provide “Clear Picture” transmission and recording of all cameras.

2) All Video for each cameras shall be transmitted to video recording server without degradation of intelligence or color fidelity.

3) The picture shall be free of Distortion, Pixilation, Flicker, Snow, Ghosting, Frame Loss, Pixel Loss, and other forms of interference.

4) The system shall produce live and recorded video acceptable to the Owner’s Representative and the Design Professional.

c. Video Recording:

1) All IP Video Surveillance cameras provided under this project shall be recorded by the system.

2) The system shall configured to be of capable of recording all cameras provided at a maximum frame rate and full resolution.

d. Video Storage Capacity:

1) The System shall be configured to provide a minimum of 30 days of video storage of all cameras.

2) The Storage capacity shall be configured based on the following criteria:

(a) Operation hours: 24 hours per day.

(b) Expected motion during daytime operation hours: 80%.

(c) Expected motion during night time lock-down hours: 25%.

e. Live Video Display:

1) The system shall be capable of displaying all selected cameras at full frame rate at maximum resolution.

2) The system shall allow the user to select any camera to display on any system monitor.

3) The system shall be configured to display full screen live video on all system monitors simultaneously.

f. Multiplexed Live Video Display:

1) The system shall be capable of displaying multiplexed video on all system monitors provided.

2) The system shall be configured to provide a 4x4 multiplexed video on all system monitors simultaneously.

3) The system shall support the following multiplexed views:

(a) 4x4.

(b) 3x3.

(c) 2x2.

4) The system shall support custom multiplexed screens.

5) The system shall support both programmed and user-selected multiplexed screen.

6) The system shall support an unlimited amount of programmed multiplexed views.

g. Recorded Video Display:

1) The system shall be capable of displaying recorded video on all system monitors without delay, video degradation, or loss of frames.

2) The system shall be capable of displaying recorded video at up to 15FPS at maximum resolution on each system workstation simultaneously without delay, pixilation, freezing, jumping, etc.

3) The system shall be capable of displaying recorded video in a single camera screen or multiplexed view.

h. Duplicate image display:

1) The system shall be capable of displaying live video from any single camera on all monitors simultaneously.

2) The system shall be capable displaying recorded video from any single camera on all monitors simultaneously.

3) The system shall be capable of displaying any selected multiplexed view on all monitors simultaneously.

4) The system shall be cable of displaying any selected camera in a different multiplexed screen on each system monitors simultaneously.

2. System Components:

a. Video Surveillance System Server:

1) The Server shall run the system software and control the entire Video Surveillance network.

2) The server shall provide the system management, control, logging, and recording functions.

3) The contractor shall provide additional servers as needed to meet performance requirements and as required for overall system function.

4) The contractor shall provide all storage devices - Additional Hard drives, RAID, NAS, or SAN required for full system function.

b. Central Control Center Video Workstations:

1) Provide video workstations as shown on Contract Drawings.

2) Viewing stations shall include as a minimum the following:

(a) One (1) network workstation.

(b) One (1) 22” LED monitor for camera video display for alarm call-up.

3) The contractor shall provide any additional network workstations required to support monitors. All workstations provided in the security control room shall be configured to function as a single integrated unit.

3. System Function:

a. Map based GUI. Refer to Sections 28 40 00 and 28 05 30.

b. Menu Based Navigation:

1) The system shall provide pull down menus to allow quick access to camera selection, multiplexed view display, and configuration screens.

c. Camera Selection:

1) The user shall select a camera for display by clicking on the cameras icon or selecting the camera from a pull down menu.

2) Selecting a camera shall also display any control option available.

3) The system shall allow the user the option of hiding rest of the graphical user interface to view the single camera video screen full screen.

d. Multiplexed View Selection:

1) The User shall select multiplexed views by first selecting a monitor then selecting a preprogrammed view from the a drop down menu.

2) The user shall be cable of creating a custom multiplexed view by selecting a monitor, the number of camera, and the cameras to be displayed.

3) Selecting any single camera view in a Multiplex view will switch that camera to a full screen view. The full screen view shall be displayed on the call-up monitor if this mode is enabled.

4) The system shall allow the user the option of hiding rest of the graphical user interface to view the multiplexed video screen full screen.

e. Auto Camera Call-Up:

1) The system shall allow the user to assign any monitor for event driven automatic camera call-up.

2) Events shall include the following:

(a) Door control.

(b) Intercom call.

(c) Camera motion detection.

(d) Video motion detection.

3) The call-up monitor shall automatically switch to the programmed camera when an event is registered.

4) The system shall be capable of supporting several call monitors and assigning camera to different monitors.

5) The user shall be able to disable camera call-up. The system shall display a status icon when camera call up is disabled.

f. PTZ Camera Control:

1) The system shall display PTZ camera controls when PTZ cameras are selected.

2) The system shall provide mouse driven target selection controls, icon based control and traditional PTZ Keyboard control.

3) The following PTZ control icons shall be available:

(a) Up.

(b) Down.

(c) Right.

(d) Left.

(e) Zoom in.

(f) Zoom out.

(g) Auto focus.

4) The system shall support preset views and auto panning.

5) The system shall support auto-switching between preset tour groups.

6) Presets, Auto Panning, and tours shall be selected from a drop down menu.

7) The system shall provide access to complete programming of menus embedded in the selected camera.

g. Recorded Video Playback:

1) The user shall access recorded video playback by selecting any camera.

2) When a camera is the selected, the system shall display the option to view the recorded video for that camera.

3) Selecting to enter the recorded video review mode will display a full set of video control icons and icons for starting search functions.

4) The video review mode shall permit the review of single full screen or multiplex video.

4. Additional Features:

a. Camera Labeling:

1) The system shall allow individual camera labeling up to 16 characters.

2) The Server’s cameras, microphones and sensors can be named. Cameras can be setup as PTZ-type and full descriptions can be assigned.

b. System shall provide individual camera indication of the following:

1) Alarm indication.

2) Video loss.

3) Date and time.

c. The system shall provide user-selectable recording modes including the following:

1) Continuous recording.

2) Event recording.

3) Sequential recording.

d. The system shall allow video search by the following categories:

1) Time.

2) Date.

3) Location.

4) Event.

5) Camera.

e. The system shall provide post image processing with the following features:

1) Digital zoom.

2) Image enhancement.

3) Contract.

4) Brightness.

f. The system shall provide digital motion detection with the following user-selectable settings:

1) Zone size.

2) Zone sensitivity.

3) Number of pixels required to create an alarm condition.

g. The system shall provide remote camera configuration menus.

h. The network video recording software shall support the following backup formats:

1) NAS.

2) CD-R/RW.

3) DVD+/-R/RW.

4) External USB storage.

i. Network video recording software shall support full search capabilities of video stored on backup media.

j. The network video recording software shall have the capability to assign a number and label to each camera as required by the Owner.

k. Contractor shall provide all required software for remote access of recorded and live video by any computer provided by the Owner over the security network.

l. System Shall provide ability to provide site name and authorization established by User and Group. Permissions can be assigned for all system functions.

m. IP Camera Alarm Processing:

1) The system shall be capable of monitoring alarm points and motion detection built in the IP Cameras provided.

2) IP Camera inputs and monitoring point alarms shall be logged and annunciated by the system.

3) The system shall be capable of using camera motion detection and monitored contacts to triggering for the following features.

(a) Change frame rate to any cameras for duration of event.

(b) Mark recorded video as an alarm event.

(c) Initiate video call up.

(d) Trigger PTZ Preset , auto panning or tour.

(e) Send alarms to all workstation.

4) The system shall be capable of editing and deleting any monitoring or motion detection point.

n. Video Authentication:

1) The system shall provide Authentication marking for all archived video.

o. The software shall employ a compression algorithm based on:

1) Optimized MPEG-4, MPJPEG, and/or H.264.

2) User selectable resolution (quality) not requiring a need to restart the application or the network video recorder. There shall be multiple levels of resolution with different levels of compression available.

p. The software installed in both servers and workstations shall be similar in:

1) Graphical User Interface, therefore, an operator shall need to learn only one (1) interface for both control and programming of the system.

2) Functions offering the ability to remotely configure most system components from any recorder or workstation.

q. Auxiliary Inputs and Audio Monitoring:

1) The software shall offer features including the simultaneous display, playback, distribution and archive of multiple channel video and audio. It shall collect multiple channels of analog video and digitize them for the purpose of display, archive and requested distribution across the Ethernet network. Cameras, microphones and sensors shall be the primary analog input devices. Each channel of video and audio data shall have the capability of being displayed, played back, distributed and archived simultaneously across several servers and clients across the network. Each sensor channel shall support a NO or NC device.

r. User Management:

1) The system shall be configured to control user access and rights through individual User Ids and User Groups.

2) The system shall require each user to logon to gain access to the system.

3) The login window shall consist of a User Name and Password field.

4) The system shall support an unlimited amount of User logon Ids and User Groups.

5) Access rights can be granted to individual users or entire user groups.

6) The software shall allow for each group to be authorized or denied access, per component, to:

(a) Log-in.

(b) Log-out.

(c) Set-Up.

(1) Network Setup & Site Name.

(2) User and Group Management.

(3) Auto Login.

(4) Macro – Create & Edit.

(5) Alarm Setup.

(6) Authentication Settings.

(7) Device Setup.

(8) Pre & Post Alarm.

(9) Storage Database Utilities.

(10) Auto Record.

(11) Exit to OS.

(12) RS-232 and/or Ethernet Setup.

(13) Priority Setup.

(14) Registration Setup.

(15) Manual Record Setup.

(16) Reports.

(17) Scheduler/Macro.

(18) Shutdown/Close.

(19) Record.

(20) Stop.

(21) Change Quality.

(22) Picture.

(23) Export.

(24) Print.

(25) Controls.

(26) Live View.

(27) Playback.

(28) PTZ.

(d) Access to all programming menus.

s. System Scheduling:

1) The system shall be capable of automatically adjusting system setting via a scheduling interface.

2) The scheduling interface shall control the following features:

(a) Recording settings by individual camera.

(b) Monitor Configuration.

(c) Alarm notification.

(d) Camera tours.

(e) System backup.

(f) User access.

(g) Alarm notifications.

H. IP Video Surveillance Management, Recording, and Viewing system shall be as manufactured by Avigilon.

2.10 DIGITAL VIDEO NETWORK WORKSTATIONS AND NETWORK VIDEO RECORDERS

A. Workstation

1. The Workstation shall be a state-of-the-art PC computer running Windows 11. It shall be fully equipped with the Digital Video Recording and Network Software. The workstation shall include at minimum a 27” monitor that meets the specifications outlined in section 2.8.

2. The Workstation shall have a 500 watt power supply using a current generation Intel® Core i5 processor or greater. It shall have a minimum of 16 GB of RAM memory, a 1 TB hard drive, CD/ DVD-R/RW drive, a Gigabit Ethernet interface, a Video Display Adapter using a workstation grade NVidia® GPU with 8 GB of RAM memory, or equal, and additional case fan cooling. The Workstation shall be equipped with a standard USB, optical wheel mouse and Microsoft-compatible keyboard.

3. The Workstation shall be housed in a tower case with all suitable connectors available on the back panel. It shall also be operated indoors in a temperature range not to exceed 40º to 95ºF (5º to 35ºC) and a humidity range not to exceed 8 to 85% relative, in a non-condensing atmosphere. The Workstation shall employ a Universal Voltage Power Supply requiring 105 – 240 VAC @ 50 – 60 Hz.

4. Provide additional graphics hardware to meet the required number of display monitors at each location as shown on the contract drawings.

5. The Workstation shall be as manufactured by Dell or approved equal.

B. Video Surveillance System Server

1. Server shall be a state-of the-art server grade computer running Windows Server 2022 operating system. Server shall be fully equipped to operate VMS software for video and storage management.

2. Server shall be rack mountable, using a current generation Intel Xeon -Core Processor at 2GHz or greater. It shall have minimum 16GB of DDR4 RAM, Gigabit Ethernet adapter x 4, and SATA-III 7200 RPM Enterprise Class Hard Drives.

3. Server shall be mounted in an industry standard 19-in. (483 mm) rack.

4. Server shall be as manufactured by Dell, HP, IBM, or approved equal.

C. Network Video Recorders

1. The RAID storage system shall be an iSCSI data storage unit suitable for any Digital Video Recording System. The RAID shall be compact and rack mountable making it suitable for any installation that requires high-capacity storage with a small footprint. The system shall provide sufficient storage space to hold the amount of video listed previously under “Video Storage Capacity” (sec.1.4, par. C).

2. The RAID storage system shall support at a minimum the use of 12 Serial ATA 3Gbps (SATA-II) Hard Drives with a minimum capacity of 1TB each in a RAID 5 or RAID 6 configuration. The RAID system shall have dual, redundant power supplies and dual gigabit Ethernet ports. All drives shall be “hot-swappable,” allowing removal and installation of the drives without powering down the array.

3. The RAID storage system shall be mounted in an industry standard 19-in. (483 mm) rack.

2.11 CAMERA POWER SUPPLIES

A. Provide power supplies as required for all external Video Surveillance equipment shown on Contract Drawings.

B. The power supplies shall be available in several sizes and input/output configurations for specific application from power calculations. Power supplies shall be available in NEMA type 4 rated enclosures as a complete package available from the manufacturer. Sizes are as follows:

1. 24 VAC, 4 fused outputs: 4A, 7.25A or 12.5A.

2. 24 VAC, 8 fused outputs: 4A, 7.25A, 12.5A or 25A.

3. 24 VAC, 16 fused outputs: 8A, 14.5A or 25A.

4. 24 VAC, 32 fused outputs @ 14.5A.

C. The power supplies shall be Class 2 limited current outputs.

D. The installation contractor shall size and select the power supply based on current requirement calculations including the load of the cameras, camera housing, fiber converters, and video subsystem support equipment selected.

E. The power supply shall be sized 20% over the required load. Submit all calculations with shop drawings for approval.

F. The video power supplies shall be Altronix Type ALTV24 designed for Video Surveillance applications, or approved equal.

G. All camera power supplies shall be housed in an oversized cabinet to provide ample room for wiring fiber converters and connections, and tamper-resistant.

H. The power supplies shall be UL-listed and approved.

I. All cable penetrations into the NEMA type 4 power supply enclosure shall be watertight. HUBs and UF connectors shall be incorporated to maintain the watertight rating on the complete assembly.

PART 3 EXECUTION

3.1 INSPECTION AND PREPARATION WORK

A. This Contractor must examine the conditions under which the system installation is to be performed, and notify the Owner's Representative or Design Professional in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to provide a workmanlike installation.

B. Review areas of potential interference and resolve conflicts before proceeding with the work. Coordinate ceiling layout and wall layout and other work, which penetrates or is supported throughout the space of the building. All work shall be flush and workmanlike in all finished areas.

3.2 INSTALLATION

A. All equipment shall be installed per the requirements of the manufacturers.

B. All equipment shall be utilized for the purpose for which it was designed and manufactured.

C. All cameras shall be installed at the approximate locations shown on the Contract Drawings. Field adjustments shall be made as required to provide the field of view of the area to be monitored.

D. Electric power and power supplies shall be provided for all equipment as required and supplies shall have the performance characteristics compatible with the unique requirements of the equipment being supplied. Power supplies shall be loaded to a maximum of 60% of the rated power output.

E. All surface mounted conduit and infrastructure shall be painted to match mounting surface as directed by the Owner.

3.3 SYSTEM SETUP

A. The Systems Contractor shall be responsible for the setup and programming of the security system.

B. All Video Surveillance camera viewing areas and focus shall be as directed by the Owner.

C. The network digital video recorder shall be completely programmed. All fields shall be set as directed by the Owner.

D. A manufacturer's representative shall be on site during final screen setup and programming of the digital recorder.

3.4 FIELD QUALITY CONTROL

A. Verify, prior to installation of enclosures, that field of view of camera is not obstructed. If such conflicts occur, coordinate with Contracting Officer prior to installation.

3.5 ADJUSTING, TESTING AND CLEANING

A. See Section 28 05 00 - GENERAL REQUIREMENTS FOR SECURITY SYSTEMS.

3.6 TRAINING

A. See Section 28 05 10 - SPECIAL REQUIREMENTS FOR SECURITY SYSTEMS.

END OF SECTION 28 60 00

SECTION 28 46 21.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. Notification appliances.
4. Addressable interface device.

B. Related Requirements:
1. Section 271513 "Communications Copper Horizontal Cabling" for cables and conductors for fire-alarm systems.

1.2 ACTION SUBMITTALS

A. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
a. Trained and certified by manufacturer in fire-alarm system design.
b. NICET-certified, fire-alarm technician; Level III minimum.
c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: For fire-alarm system.
1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.

10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.
12. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, accessories, and components, from manufacturer.

C. Field quality-control reports.

D. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.

c. Complete wiring diagrams showing connections between all devices and equipment.
d. Riser diagram.
e. Record copy of site-specific software.
f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
    1) Equipment tested.
    2) Frequency of testing of installed components.
    3) Frequency of inspection of installed components.
    4) Requirements and recommendations related to results of maintenance.
    5) Manufacturer's user training manuals.
g. Manufacturer's required maintenance related to system warranty requirements.
h. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

C. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FM Global-approved alarm company.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.

C. Automatic sensitivity control of certain smoke detectors.

D. All components provided shall be listed for use with the selected system.

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

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:
1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Carbon monoxide detectors.
6. Automatic sprinkler system water flow.
7. Fire-extinguishing system operation.
8. Fire standpipe system.
9. Dry system pressure flow switch.

B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Activate preaction system.
9. Coordinate first subparagraph below with "Elevator Recall" Paragraph in "Fire-Alarm Control Unit" Article.
10. Recall elevators to primary or alternate recall floors.
11. Activate elevator power shunt trip.
12. Activate emergency lighting control.

13. Activate emergency shutoffs for gas and fuel supplies.
14. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
3. Elevator shunt-trip supervision.
4. Loss of communication with any panel on the network.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, or remote annunciator.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.

E. System Supervisory Signal Actions:
1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. After a time delay of 200 seconds transmit a trouble or supervisory signal to the remote alarm receiving station.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:
1. Existing fire alarm control panel is Notifier by Honeywell maintained by Alarm Tech System ATS at 501 Crescent Avenue, Suite 200 reading , PA 19605, 610-916-1090 .

B. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

C. Elevator Recall:
1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

a. Elevator lobby detectors except the lobby detector on the designated floor.
b. Smoke detector in elevator machine room.
c. Smoke detectors in elevator hoistway.

2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
   a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38.
   1. Single-action mechanism, key operated type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
   2. Station Reset: Key- or wrench-operated switch.

2.5 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
   1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.

B. Chimes: Vibrating type.

C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464.

D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
   1. Mounting: Wall mounted unless otherwise indicated.
   2. Flashing shall be in a temporal pattern, synchronized with other units.
   3. Strobe Leads: Factory connected to screw terminals.
   4. Mounting Faceplate: Factory finished, white, with security cage.

2.6 ADDRESSABLE INTERFACE DEVICE

A. General:
   1. Include address-setting means on the module.

2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal
1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:
1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

C. Equipment Mounting: Install fire-alarm control unit on finished floor.

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

E. Manual Fire-Alarm Boxes:
1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

F. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.
   1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
   1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
   1. Smoke dampers in air ducts of designated HVAC duct systems.
   2. Magnetically held-open doors.
   3. Electronically locked doors and access gates.
   4. Alarm-initiating connection to elevator recall system and components.
   5. Alarm-initiating connection to activate emergency lighting control.
   6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
   7. Supervisory connections at valve supervisory switches.
   8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
   9. Supervisory connections at elevator shunt-trip breaker.
   10. Supervisory connections at fire-extinguisher locations.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Visual Inspection: Conduct visual inspection prior to testing.
      a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter.
      b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
   2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
   4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
   5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
   6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

C. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

D. Fire-alarm system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

G. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
   1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 28 46 21.11

SECTION 28 50 00- INTERCOM AND PAGING SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Conditions of the Contract, including the General and Supplementary Conditions and Division 28 specification sections apply to this Section.

B. Refer to Contract Drawings and Specifications listed in Section 28 05 00, for additional requirements.

1.2 DESCRIPTION OF WORK

A. Provide Intercom and Paging (IPA) System as shown on the Contract Drawings. The IPA system integration shall include duplex voice communication between the primary intercom stations and all substations.

B. Integrate the existing intercom substations into the new intercom and paging system. Provide expansion units, converters, and inputs as required to connect all existing devices to remain. Reuse existing cabling from substations to the equipment room panels.

C. Acceptable site wide integration shall include Internet Protocol (IP) via the security network, DTMF signaling through tie lines and RS232 control signaling. Acceptable systems integration shall include IPA, Central Processing System/Programmable Logic Control System interfacing required for implementation of signaling and controls shown on the contract documents.

D. The IPA system shall include multiple voice channels/paths as required for simultaneous operation of all control consoles provided under this contract, in conjunction with each locally controlled area and required site wide IPA communication specified.

E. The work provided by the contractor shall include the following:
   1. All Intercom and Paging System components, including conduit, cabling, interfacing, connections and programming for the multiple primary intercom and paging stations as shown on Contract Documents.
   2. All Intercom and Paging System components, speakers, horns, conduit and cabling for all control consoles.
   3. The headend and control system shall be expandable.

F. The Intercom and Paging System shall include functions such as "ALL CALL/EMERGENCY PAGE," "GROUP-CALL," and other similar combinations. These shall be re-programmed at no charge to the owner upon "shake-down" of the facility and direction by the owner.

G. Provide separate volume controls and amplifiers for each zone. The volume controls shall be located in the Security Equipment Room.

H. Provide coordination with other trades and contractors as required for a complete, functional and trouble-free Intercom and Paging System.

I. Provide weather proof intercom sub-stations mounted in a dual height pedestal located at the entry and exit locations of the intake vehicle sallyport as outlined on the Contract Drawings.

J. Provide all labor, materials, equipment, testing and services necessary for and incidental to furnishing and installing intercom system. Provide as shown on Contract Drawings stainless steel tamper-proof Sub-Stations at each location shown. Provide power supplies, audio power amplifiers, backboxes and all required system accessories. Provide cabling run, as required, through the site communications duct bank as shown on Contract Drawings. Provide cable connector modules, weatherproof splice bodies and any appurtenances required for a fully functional system.

K. Coordinate cabling, system components and their arrangements electrically and mechanically. Provide 6 ft. cable loops in all locations.

L. Provide Sound Detection and Audio Monitoring through the Primary Intercom Stations.

M. Provide interface to the ACS Security Control Systems.

N. Provide line fault indication for all circuits.

O. Intercom and Paging Systems should conform to the following:
   1. Intercom: The Intercom System shall be interfaced with the Security and Control System to allow the various control center operators to communicate directly through the Touch Control Screen and Graphic Control Screens, to substations located throughout the facility. Intercom Stations shall be hands-free operation from the remote call-in stations, push-to-talk at control stations, stainless steel construction, and flush mounted.
   2. Paging: Paging shall be provided throughout the facility. The Central Control Center (CCC) shall include global paging for the entire institution and zoned paging for each housing unit and department/jurisdiction.
   3. The system shall include the following functions:
      a. Door control intercom.
      b. Intercom station audio monitoring.
      c. Zoned public address.
      d. Output and event response control.
   4. The system shall integrate with the following other security and communication systems to form a comprehensive facility management network:
      a. Access Control system.
      b. Touch screen control system.
      c. Video Surveillance system.

1.3 SYSTEM OPERATION

A. Intercom Master Station General Operation:
   1. Primary Intercom Station shall include a minimum 2-line LCD display to provide alphanumeric descriptions of functions, station and device names, and current activity. Function key

labeling to change depending on the location within the menu structure or options available to the operator.

2. Master station shall normally display the identity of the top two calls in its call request queue. Call identity shall include the device ID number and/or an alphanumeric descriptor. Descriptor shall be up to 12 characters.
3. The master station display shall indicate the total number of calls currently in its queue. Scroll keys shall enable the master station to view all calls in the queue.
4. Master station to display, in a defined area, the number of acknowledged calls, and number of stations removed from service or monitor points in bypass mode.
5. Master stations, through their command functions, to have the ability to:
    a. Answer calls.
    b. Place calls.
    c. Place calls on hold.
    d. Transfer calls to another master station.
    e. Place conference calls.
    f. Place group calls.
    g. Make zoned public address announcements.
    h. Monitor intercom stations.
    i. Independently adjust each station's volume level.
    j. Remove stations from service.
    k. Recall the last station with a single control.
    l. Adjust display back lighting.
    m. Select 12 or 24-hour clock display.
    n. Adjust the step rate for switching between monitored stations.
6. Provide for volume adjustment of master station and intercom levels shall be controlled during communications. Each station's volume level shall be independently software-controlled. Level settings shall remain in effect until modified by a future adjustment.
7. Master stations shall include the ability to be placed in an unmanned mode which automatically routes all of the associated call handling functions to a pre-defined secondary master station.
8. The system shall automatically release the speech path if dialing is not completed within a pre-programmed time period, typically five seconds.

B. Intercom Substation General Operation:
1. Depressing an intercom station's call push-button shall place a call request in the queue of the master station or stations assigned to receive that station's calls. Calls shall be queued in order of priority level associated with the intercom station and time the call was placed.
2. Calls not answered within a pre-programmed time shall place a secondary call request to an assigned master station.

C. Call answering at an intercom master station shall provide for the following:

1. Intercom master stations shall be able to answer the top call request in its queue by depressing the 'Next' function key. At the completion of the call, the 'End' function key shall close the communication link and remove the call from the queue.
2. Subsequent calls may be similarly handled for the remaining calls in the queue.
3. Queued calls may be answered out of sequence by scrolling through the queue to the desired call. The selected call to flash on the display and shall be answered by depressing the 'Enter' key. 'End' key shall close the communication link, remove the call from the queue and return the master station display to the top of the queue.
4. A call that is currently connected to a master station shall display that the call is connected, the type of device connected, and the identity of the connected device.

D. Voice Communication shall provide for the following:
1. Telephone handset voice communication between intercom master stations shall be full duplex.
2. Open voice communications between intercom master stations shall be automatically switched half duplex with press-to-talk override.
3. Voice communications between intercom master stations and intercom stations shall be automatically switched half duplex with press-to-talk override.

E. Station monitoring shall provide for the following:
1. Master stations shall be able to monitor an individual intercom station or a pre-defined group of intercom stations.
2. System shall permit establishing as many station monitor groups as there are unused station ID numbers.
3. Each master station shall individually control the rate at which stations in the monitor group are sequenced through.

F. Paging shall provide for the following:
1. Master stations shall have the ability to page to pre-determined groups of intercom stations and/or loudspeaker zones.
2. Paging selection shall be made by selecting the page function and a group or zone from the selection list. Alternately, the zone number may be entered after the page function has been selected.

1.4 FUNCTIONAL REQUIREMENTS

A. System shall be capable of assigning station and group numbers within a minimum range of 0 to 9999.

B. System shall be capable of assigning an alphanumeric description for each device, group, zone, etc. with a minimum of 12 characters and spaces.

C. All intercom station field wiring shall be supervised for short circuit and open circuit faults.

D. All system boards shall include self-diagnostic functions for complete operational and communication testing.

E. All system boards and devices shall be able to be inserted or removed from service while the system is fully operational. Other system activity not directly related to the board insertion or removal to not be affected.

F. System diagnostics shall include the ability to test system communications and devices from the service, administration, and control computer.

G. System shall include the ability to make on-line changes to the system configuration.

H. System shall include logging functions for system activity and system maintenance.

I. System shall include the ability to print, through an optional printer, activity and maintenance logs.

J. On-line factory support shall be available through a modem connection to the service, administration and control computer.

1.5 PERFORMANCE REQUIREMENTS

A. System frequency response: 300 to 3,500 Hz.

B. Intercom station output: 82 dB SPL at 3 feet with 82 dB SPL input at face of transmitting station.

C. Maximum time from call placement to annunciation at intercom master station: 1.0 second.

D. Maximum time to complete call connection upon receipt of command from intercom master station: 1.0 second.

E. All system equipment to comply with the radiation limits for Class A digital devices of FCC Rules Part 15, Subpart B.

1.6 ELECTRICAL POWER REQUIREMENTS

A. Provide all power as required. Coordinate all power and infrastructure requirements with the Division 26 Contractor.

1.7 QUALIFICATIONS

A. Contractor shall be qualified and certified by the manufacturer prior to installation and programming.

1.8 QUALITY CONTROL

A. Intercom and Paging System components shall meet the requirements of all applicable codes and standards. All equipment shall be of maximum-security correctional grade.

B. The Contractor shall strictly adhere to the installation instructions provided by the system manufacturer and shall provide certification reports from the manufacturer's Representative that all installation instructions have been satisfactorily complied with.

C. All equipment shall be Underwriters Laboratory/CSA listed.

1.9 RELIABILITY

A. Provide Intercom and Paging System with mean time before/between failure of minimum 36,000 hours.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Intercom and paging equipment shall be as manufactured by Commend, no approved equal.

2.2 SYSTEM ADMINISTRATION AND CONTROL SERVER

A. The Service, Administration and Control (SAC) computer shall provide the processing for the system's operation, configuration functions, and maintenance functions.

B. Interface to the I/O card cages, master stations, and remote intelligent devices shall use Ethernet port connections.

C. Interface to the ACS door control system shall be an industry standard RS-232 or Ethernet addressable connections.

D. SAC computer shall support the ability to be upgraded to a redundant configuration by adding a second SAC computer and interface cards. No existing equipment to be obsolesced by redundancy upgrade.

E. SAC computer shall meet the requirements of the workstation computers specified in Section 28 40 00 with the addition of the following:
   1. Real Time Operating System.
   2. Communications system software.
   3. PCLTA cards with:
      a. LonWorks direct connect ports as required, or
      b. LonWorks free topology ports as required; or
      c. Ethernet IP ports.

2.3 2-WIRE STATION CONVERTERS

A. 2-wire station converters shall connect the existing 2-wire intercoms to the new server based intercom system.

B. The converters shall have the following features:

   1. (2) RJ-45 ports for Ethernet (10/100 Mbit/s)

2. D-SUB connection for 8 devices

3. Fully compatible with the provided intercom software and server

4. 24 VDC power supply

5. ½ rack form factor

2.4 POWER SUPPLIES

A. Each I/O card cage shall be provided with an associated external power supply designed for mounting in 3u space of standard 19" equipment racks.

B. Input source to 100-120 VAC, 10 A maximum. Outputs shall be capable of providing up to 30 A at ± 12 Vdc. Voltage regulation ± 10%. Maximum ripple 1% peak to peak.

C. Units shall include independent dual supplies, front panel power switch and line power indicator, and independent supply status indicators. AC line input shall be fused and protection circuitry shall be provided for overload and over voltage conditions.

D. Power supplies shall incorporate rear mounted fan and filter assembly and ventilation slots in the front and side panels.

2.5 NETWORK REPEATERS

A. Network repeaters, if required, shall extend network cable limits or increase node limits. Each unit shall include network ports required. Data received on any port shall be re-transmitted on the other ports.

B. Units shall be surface wall mounted and include depluggable screw terminal connectors, redundant power supply connections and internal fuse to protect circuitry.

C. LED's shall indicate receiving port, network activity, and power supply status.

2.6 DESKTOP INTERCOM MASTER STATIONS

A. Desk top intercom master stations shall consist of display, keypads, internal speaker/microphone, and telephone handset with hookswitch.

B. Display module shall consist of a 2 line by 12 character minimum alphanumeric LCD display mounted behind a brushed stainless steel face plate. Display shall include scratch and impact resistant window and adjustable back lighting.

C. Function keys shall be provided below display to enter menu selections. Function key action shall be labeled on display and vary according to location in the menu structure or current options available.

D. Separate keypad shall include standard 10/12 numeric keypad keys, two scroll keys, enter key, clear/cancel key, press-to-talk key, and other keys required for proper functioning.

E. Key switch lifetime for all keys: 10 million operations.

F. Internal intercom station audio interface shall consist of:
1. Network and power supply interface, audio amplification and processing module, network and operating status LED's.
2. Connectors and LED's shall be rear panel mounted.
3. Internal loudspeaker/microphone assembly.
4. External microphone interface with phantom power capability.
5. External loudspeaker interface.
6. Headset jack interface.
7. External buzzer contact closure interface.

G. Telephone handset and press-to-talk bar and hookswitch cradle shall be mounted on side of master station. Lifting handset from hookswitch shall automatically disconnect loudspeaker/microphone communications. Handset assembly shall incorporate standard coiled cord covered by armored flex.

H. Desk top mounted intercom master station top housing assembly shall be fabricated with single piece, brushed stainless steel, and slope-faced face plate. Rear, bottom, and side panels shall be single piece formed steel with welded joints and matte black finish.

2.7 PANEL MOUNTED INTERCOM MASTER STATIONS

A. Panel mounted intercom master stations shall consist of display module, master audio interface module, and handset/loudspeaker/microphone module.

B. Display module shall consist of:
1. Two (2) line by 12 character alphanumeric LCD display mounted behind a brushed stainless steel face plate. Display shall include scratch and impact resistant window, adjustable viewing angle, and adjustable back lighting.
2. Brushed stainless steel faceplate.
3. Five (5) function keys below display that are used to enter menu selections. Function key action shall be labeled on display and vary according to location in the menu structure or current options available.
4. Nineteen (19) button keypad including standard 12 numeric keypad keys, two scroll keys, enter key, clear key, headset key, mute key, and press-to-talk key.
5. Key switch lifetime for all keys: 10 million operations.
6. Ribbon cable header to master audio interface module.

C. External master audio interface module shall consist of:
1. Network and power supply interface, audio amplification and processing module, network and operating status LED's, ribbon cable header for connection to display module.

2. External microphone interface with phantom power capability.
3. External loudspeaker interface.
4. Telephone handset with press-to-talk switch interface.
5. Headset jack interface.
6. External buzzer contact closure interface.
7. Surface wall mount enclosure.

D. External handset, loudspeaker and microphone module shall consist of:

1. Two (2) 1/2" diameter Mylar cone loudspeaker, microphone, and handset cradle on a 14 gauge stainless steel faceplate designed for mounting on a standard 4-gang electrical device box.
2. Loudspeaker shall include offset baffle. Microphone shall be acoustically isolated from enclosure and be resistant to spray.
3. Telephone handset cradle with internal hookswitch and configured for vertically hung handsets.
4. Black telephone handset with press-to-talk bar and armored connecting cable.

2.8 INTERCOM STATIONS

A. Intercom stations shall be tamperproof and weatherproof, maximum security grade, single button recessed intercom stations, designed for mounting on standard 2-gang outlet boxes. Contractor shall confirm size and provide accordingly. Faceplates shall be constructed of brushed stainless steel. Internal steel offset grille shall restrict inserting objects through speaker grille. Stations shall be ruggedly constructed and resistant to damage from soil and sprays.

B. Each intercom station shall incorporate an internal loudspeaker, microphone preamplifier and function multiplexing circuitry. One pushbutton shall be provided on each station. Pushbuttons shall be software assignable for placement of call requests.

C. Pushbuttons shall be single piece stainless steel construction and be back stopped to prevent excessive travel. Switch shall have positive tactile action with 1 million operation lifetime.

D. Loudspeakers shall be waterproof Mylar cone type.

E. All intercom station functions shall be transmitted over a single shielded pair cable. Stations shall be provided with MTA type insulation displacement connector that requires no wire stripping for installation.

F. Outdoor intercom stations shall be identical in all respects to standard intercom stations except that all metal plates and hardware to be stainless steel, and internal circuitry and components to be conformally coated.

G. Each button shall be programmable, through the system, to call the master stations or to access any specific group function, e.g., group call, alarm call, etc. The labels and buttons shall be color coded, thorough fluorescent paint fill, within the engraved labeling and graphic identifiers.

2.9 EXTERNAL PERIMETER GATE SUBSTATIONS

A. Provide intercom substations with a single call-in button located for each pedestal for the perimeter gate entrance and exit and vehicle sallyport entrance as shown on the Contract Drawings.

B. External perimeter gate substations shall include:
1. Pushbutton to call master station.
2. Compact pedestal-mount design to mount on dual-height vehicle pedestal.
3. Hands-free communication when master answers.
4. Communication only with the intercom master station located in the Master Control Center.

C. Provide weatherproof housings for each substation.

D. Provide all cabling install in conduits provided by other trade outlined in other sections of these specifications.

2.10 LOUDSPEAKER INTERCOM TALKBACK KIT

A. Intercom talkback kits shall be used to interface 8 ohm loudspeakers to system headend for two-way voice communication or audio monitoring in padded cells.

B. Units shall include microphone preamplifier, line supervision electronics, loudspeaker transformer, and mounting hardware.

2.11 WIRE AND CABLE

A. Factory manufactured field interface cables shall be provided, as required, for all:
1. Audio control boards.
2. Station audio boards.
3. Audio input boards.
4. Paging amplifier boards.

B. Field wiring shall conform to manufacturer’s recommendations.

2.12 CEILING MOUNT PAGING SPEAKER

A. Provide all paging speakers as shown on Contract Drawings.

B. Loudspeakers shall be nominal 8” diameter dual cone type units.

C. Loudsperkers shall have 8 or 16 ohm impedence and include multi tap transformer for use in 25 volt and 70 volt constant voltage type distribution systems.

D. Provide Atlas Sound, Series VP60-R recessed baffles (or approved equal), speaker enclosures and speaker installation appurtenances as required for ceiling mount, flush/concealed installation of speakers in all finished areas.

E. Provide loudspeakers as manufactured by SoundTube CM EZII, Atlas Sound, TOA, or approved equal.

2.13 EXTERIOR PAGING SPEAKER HORN

A. Provide paging horns to allow intercom system paging exterior areas. The horn shall produce, as a minimum, 120 dB at 4 feet with 20 watts of pink noise. Mount horns 12 ft. above finished grade level. Provide all required page adapter intercom system interface equipment. Provide wide angle professional paging horns as manufactured by Atlas Sound, Series AP-15UC or approved equal with weatherproof mounting hardware. Provide with necessary corrosion-proof hanging brackets and stainless fasteners.

2.14 PAGING AMPLIFIERS AND DISTRIBUTION

A. Provide Class 2 audio distribution for all paging speakers using 25 volt or 70 volt distribution. Conform to local code requirements for low/high voltage distribution in conduit with low voltage control and communication cabling.

B. Provide speaker matching transformers and level control transformers with less than 1% distortion at rated power. Transformers shall be rated for full capacity of loudspeakers served.

C. Provide amplifier matching transformers with less than 1% distortion at rated output power. Transformers shall be rated for full capacity of amplifier served.

D. Provide minimum of 16 Watts of amplifier power for each exterior horn speaker in power load calculations plus 50% spare capacity.

E. Provide minimum of 16 Watts of amplifier power for each sound tube or Soundsphere loudspeaker plus 50% spare capacity. Substitution of speaker driver shall require a coverage analysis to offer no less than that shown on drawings using the vertical polar response plots specified. Power amplification must be such that equal SPL is attained at listening level. The owner shall not be responsible for increased infrastructure necessary for substitution of units with lesser coverage. The Contractor shall bear all responsibility for device changes to the Contract Drawings.

PART 3 EXECUTION

3.1 ZONING AND FINAL PROGRAMMING

A. Installation shall conform to all applicable codes and standards and the requirements of the manufacturer. All intercom sub-stations shall be flush mounted at each location shown on the Contract Drawings.

B. The Contractor shall provide system programming to enable system functions as described. coordinate specific program requirements with the owner.

C. Programming shall be redone as many times as required until full approval by the owner is given.

D. The Contractor shall provide level control adjustments from panel mounted 'L' pads for each individual zone or speaker for adjustment by owner personnel.

E. Contractor shall identify each level control with permanent markings in accordance with contract documents and zoning.

F. Contractor shall identify "normal" accepted setting with permanent marking.

3.2 VERIFICATION OF OPERATION

A. Contractor shall verify all intercom, paging, signaling and programming capabilities described herein. The following capabilities shall be verified:
1. System programming capability from the Master Station.
2. All call functions, as required.
3. Group call functions, as required.
4. Alarm call functions, as required.
5. Auto callback functions.
6. Conference call functions, as required.
7. Restricted access capability.
8. Paging by zone in each area and at the sally ports by means of the external page horns.
9. Proper function and programming of substations.
10. Proper function of system programming.
11. Proper system programming as directed by the owner and Design Professional.

3.3 TRAINING

A. Manufacturers shall be responsible for providing minimum training by authorized system installers/representatives to the owner's personnel in compliance with Section 28 05 00.

END OF SECTION 28 50 00

SECTION 28 70 00 - WATCH TOUR SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Conditions of the Contract, including the General and Supplementary Conditions and Division 28 Specification Sections apply to this Section.

B. Refer to Contract Drawings and Specifications listed in Section 28 05 00, for additional requirements.

C. Refer to Divisions 11 and 26 for additional requirements and coordination efforts.

1.2 DESCRIPTION OF WORK

A. Provide all materials, labor, equipment, and services necessary for a complete Watch Tour System (WTS) as shown on the Contract Drawings and specified herein.

1.3 SYSTEM DESCRIPTION

A. The Watch Tour System shall consist of solid state touch memory buttons mounted in stainless steel correctional grade housings. The memory buttons shall be mounted outside of the bedrooms in the housing units as outlined on the Contract Drawings.

B. The Watch Tour data collection device shall be a compact, heavy duty, powered by lithium batteries device that is used by the staff to record his/her tour by touching the touch memory buttons required for the specific tour. The data recording device shall be capable of storing over 4,800 reads.

C. The collection device shall download the tour data into a data transfer device that is Ethernet linked to the server. This transfer docking station located at the local control stations shall be capable of transferring data up to 10/100 Mb/sec.

D. The Watch Tour System shall consist of Guard Tour software, installed in the Control System server in the Equipment Room. The software shall consist of the data collection function, report generation and printing, extensive on-line support and training documentation, and support of GUI screen maps. Provide all software and licenses required.

E. The data collected shall be uploaded to the Control System server automatically after every tour. Custom reports shall be generated to meet the requirements of the Owner. Coordinate with the Owner to ensure reports and custom features are programmed properly.

1.4 REFERENCE STANDARDS AND CODES

A. National Electrical Code (NEC)

B. Underwriters Laboratory (UL)

C. Refer to applicable codes and standards listed in Section 28 05 00.

1.5 COOPERATION WITH OTHER TRADES

A. The Contractor shall coordinate the Work of this Section as required to ensure that the entire Work of this Project will be carried out in an orderly, complete, and coordinated fashion.

1.6 SUBMITTALS

A. General Requirements

1. Submittals shall be made in accordance with SPECIAL REQUIREMENTS FOR SECURITY SYSTEMS SECTION. Refer to Sections 28 05 00 and 28 05 10 for additional requirements.

B. Specific Requirements

1. Submit catalog cuts for each piece of equipment, including but not limited to: touch memory devices, data collectors, data transfer docking stations, enclosures, mounting devices, brackets, software etc.

2. Submit plan drawings showing location, mounting, and field of view of each Watch Tour device.

3. Submit point-to-point wiring diagram for Watch Tour system including grounding of all system components.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the “PERFORMANCE,” “OPERATIONS” and “RELIABILITY” requirements specified, provide a system manufactured by:

1. Timekeeping Systems, Incorporated – Guard 1 Plus System to match the existing system in Building 67.

2.2 TOUCH MEMORY DEVICES

A. Provide touch memory devices as shown on Contract Drawings.

B. The touch memory devices shall meet or exceed the following requirements:

1. Each button shall contain a microchip that will be programmed with a unique ID including cell or room number. Coordinate with Owner for ID information and incident code requirements.

2. The button shall be hermetically sealed, corrosion resistant, #304 stainless steel alloy.

3. Operate without supplementary power in a -4 to 40°C environment.

4. Mount each button in a stainless steel, tamper resistant, corrections proof, wall mount. All mounting hardware shall be torx-type, tamperproof hardware.

C. Hardened Button Base shall be model MM-34A1000-001.

2.3 DATA COLLECTOR WAND

A. The data collector wand shall meet or exceed the following requirements:

1. The wand shall be made of corrosion resistant, #304 stainless steel alloy, totally waterproof and tamper resistant.

2. All electronics shall be embedded in epoxy resin.

3. The device shall be powered by lithium batteries with a minimum one (1) year warranty encased in a rubber sleeve. All battery connections shall be welded. Battery life shall be at least 2,500,000 reads.

4. The wand shall download data at a minimum of 115,200 baud.

5. The wand shall store a minimum of 4,800 unique identification points.

6. The wand shall be warranted for three (3) years.

7. Provide one (1) nylon holster for each wand provided.

8. Provide a total of 3 wands for the facility.

9. Data Collector wand shall be Model PIPE-11-TKS by Timekeeping Systems, Inc.

2.4 IP DOWNLOAD STATION/READER

A. The IP Downloader Station Ethernet linked to the server shall meet or exceed the following requirements:

1. The download station shall be ruggedly constructed to resist tampering with a weighted base to prevent tip over.

2. It shall support data transfer rates of up to 10/100 Mb\sec.

3. It shall be compatible with the server operating system software and Watch Tour System software.

4. It shall have a pushbutton power check of the wand’s battery.

5. It shall operate in a -4 to 40°C environment.

6. Operating voltage – 9VDC.

7. IP Download Station/ Reader shall be Model DL - IP by Timekeeping Systems, Inc.

2.5 WATCH TOUR SOFTWARE

A. Watch Tour software shall be installed on the Watch Tour Server.

B. The Watch Tour software install in the Control server computer shall support the following features, or meet or exceed the following requirements:

1. True 24-hour a day unattended downloading.

2. Automatic detection of readers.

3. Remote downloading.

4. Generation of professional reports using MS Word.

5. Utilize flexible, powerful rules based reporting.

6. Exceptions reports identifying missed locations.

7. Custom reports and batch reports.

8. Support for pictures and maps for identifying locations of tour devices or checkpoints.

9. Supports creation of a group of locations requiring special review – supervisor patrols, separate weekend/holiday patrols.

10. Support rules or filters that allow the Owner to specify the number of visits to a group of locations during a specific time period.

11. Data maintenance – allowing data backup on regular schedule to a CD-ROM or network device.

12. Software shall utilize Microsoft SQL server database.

13. Contractor shall assist the Owner in developing reports that meet the facility's needs.

14. Software shall be Guard One Plus Server Edition, by Timekeeping Systems, Inc.

2.6 WATCH TOUR SERVER

A. Server shall be a state-of the-art server grade computer running Windows Server 2000 with service pack 4 operating system. Server shall be fully equipped to operate Guard 1 Plus Server Edition software.

B. Server shall be rack mountable, using an Intel Core 1.7 Processor at 2.8 GHz or greater. It shall have minimum 4 GB of RAM, Gigabit Ethernet adapter, 80 GB hard drive or greater, and CD/DVD-R/RW Drive.

C. Server shall have SQL Server Reporting Services

D. Server shall be mounted in an industry standard 19-in. (483 mm) rack.

E. Server shall be as manufactured by Dell, HP, IBM, or approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Contractor shall install watch tour system components at locations as shown on the Drawings.

B. Provide systems integration as required to implement all performance and operational requirements specified. Refer to Section 28 05 30.

C. Before installation Contractor shall verify exact location on single sample door with transition staff before mounting tape spot at each location for final mount approval.

3.2 COMPLETION

A. Testing

1. Contractor shall inspect and test the installation and operation of the system completely prior to acceptance tests. Refer to Sections 28 05 00, 28 05 10, and 28 05 30 for additional requirements.

2. Acceptance tests shall be conducted in conjunction with the Owner or Owner's Representative to ensure compliance with plans and specifications.

END OF SECTION 28 70 00

SECTION 31 23 00 – EXCAVATION AND EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Pavement Removal
2. Preparation
3. Rock Excavation
4. Excavation
5. Subgrade Preparation
6. Filling, Backfilling & Rough Grading

1.2 APPLICABILITY

The specifications provided in this section shall apply only to the construction items outside of the building footprint.

1.3 DEFINITIONS

Section not used.

1.4 SUBMITTALS

A. As-built record drawings shall be submitted in to the OWNER. Record drawings shall accurately locate both new and existing utilities. Utilities shall be located both horizontally from some permanent structure and vertically by elevation.

B. Submit to the OWNER samples of each type of fill and backfill material to be used.

Quality Control. Each sample shall be representative of the fill type, weighing 10 pounds, and shall be sealed in an air-tight container and delivered to the ENGINEER or to the designated testing laboratory, if required by the ENGINEER.

C. Materials Source: Submit names of material sources.

1.5 QUALITY ASSURANCE

A. All blasting of subsurface rock, if permitted by the OWNER and ENGINEER, must be performed under the supervision and direct control of a licensed blaster with a minimum of five years of documented experience.

B. All filling and backfilling and subgrade may be laboratory and field tested to verify compaction requirements and conformance with specifications. Testing will be done as directed by the ENGINEER.

1.6 DELIVERY, STORAGE, AND HANDLING

Section not used.

1.7 REGULATORY REQUIREMENTS

A. Conform to local code requirements for disposal and/or burning of debris.

B. If blasting is permitted by the OWNER and ENGINEER, obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.

C. If blasting is permitted by the OWNER and ENGINEER, comply with all state, county and local regulations governing use of explosives for removal of subsurface rock.

D. If blasting is permitted by the OWNER and ENGINEER, comply with NFPA 495 - Code for the Manufacture, Transportation, Storage and Use of Explosive Materials.

E. Rules and regulations of the various utility companies and other authorities having jurisdiction over such Work shall be observed in the performance of all earthwork operations.

1.8 EXAMINATION

A. Verify site conditions prior to starting work.

B. Verify that survey bench mark and intended elevations for the work are as indicated.

C. Verify all underground and above ground utility line locations, pipes and other infrastructure whether or not these items are included within the categories incorporated in the PA Underground Utilities Act 187 or any amendments thereto.

1.9 PROTECTION

A. Do not damage or disturb any existing monuments, bench marks, structures, fences, sidewalks, paving, curbs and other markers. Provide suitable protection where required before starting Work. Restore any damage to original condition or repair as directed at CONTRACTOR cost.

B. Before starting Work, protect any trees or shrubs shown or designated to be saved by boxing or wire fencing staked securely in place or by other approved means. Protection shall be maintained until completion of work, or until removal is be directed by the OWNER and the ENGINEER.

C. Protect and maintain above and below grade utilities that are to remain.

D. Protect excavations and adjacent property and structures by shoring, bracing, sheet piling, underpinning or other methods as required to prevent cave-in, damage, and/or loose soil from falling into the excavation at no additional cost to the OWNER.

E. Underpin adjacent structures and utilities which may be damaged by excavation work.

F. The OWNER and ENGINEER shall be notified immediately if any unexpected subsurface condition, such as buried structures or utility lines are encountered, and discontinue work in that area until notified to proceed. The ENGINEER will determine the disposition of the obstruction. The CONTRACTOR shall adequately protect and support the obstruction until a determination is made and relocate, realign or dispose of the obstruction as directed by the ENGINEER at no additional cost to the OWNER.

G. Protect the bottom of excavations and soil adjacent to and beneath foundations from frost.

H. The top of the excavation shall be mounded or graded to prevent surface water runoff from entering the excavation.

I. Do not interfere with 45° bearing splay of foundations.

J. Erect and maintain guide rails, fences, warning lights or other protection as required for the safety of all persons at the excavations.

PART 2 PRODUCTS

2.1 TOPSOIL

A. Excavated material, graded free of roots, rocks larger than 1 inch, subsoil, debris, weeds and foreign matter.

2.2 SUBSOIL

A. Excavated material, graded free of soil masses larger than 6 inches, rocks larger than 3 inches, and debris.

2.3 ROCK

A. Any material which cannot be dislodged by a D-8 Caterpillar tractor, or equivalent, equipped with a hydraulically operated power ripper (or by a CAT 235 hydraulic backhoe or equivalent) without the use of extraordinary rock excavation techniques. Boulders or masses of rock exceeding 1/2 cubic yard in volume shall also be considered rock excavation. This classification does not include materials such as loose rock, concrete or other materials that can be removed by means other than extraordinary rock excavation techniques, but which for reasons of economy in excavating the CONTRACTOR chooses to remove by extraordinary rock excavation techniques.

2.4 BURIED STRUCTURES

A. Concrete and masonry structures not shown on the Drawings and encountered during the excavation and requiring removal shall be classified as rock.

2.5 BLASTING MATERIALS

A. Explosive, delay devices, blasting mats and other associated materials shall be the type recommended by the explosives firm and as required by the authorities having jurisdiction.

2.6 SELECT FILL MATERIALS

A. Type A - Crushed Stone: natural stone free of shale, clay, friable materials, debris and organic materials size and grading to comply with AASHTO No. 57 (PennDOT No. 2B).

B. Type B - Crushed Stone: natural stone free of clay, shale, friable material, debris and organic materials and graded in accordance AASHTO No. 3.

C. Type C - Crushed Stone or Gravel: free of shale, clay, friable materials, debris and organic materials graded in accordance with PennDOT Number 2A.

D. Type D - Sand: natural river or bank sand, washed, free of silt, clay, loam, friable or soluble materials and organic matter graded in accordance with ANSI/ASTM C136 within the following limits:

Sieve Size	Total Percent Passing
#4	100
14	60-100
50	20-80
100	10-30
200	0

E. Type E - Structural Fill: consisting of CL or better material according to ASTM D2487 with a maximum particle size of 3 inches.

TABLE C
Size and Grading Requirements for Coarse Aggregates
(Based on Laboratory Sieve Tests, Square Openings)

AASHTO Number	Total Percent Passing													
	100 mm (4")	90 mm (3 1/2")	63 mm (2 1/2")	50 mm (2")	37.5 mm (1 1/2")	25.0 mm (1")	19.0 mm (3/4")	12.5 mm (1/2")	9.5 mm (3/8")	4.75 mm (No. 4)	2.36 mm (No. 8)	1.18 mm (No. 16)	150 µm (No. 100)	75 µm (No. 200) ***
1	100	90-100	25-60		0-15		0-5							
3			100	90-100	35-70	0-15		0-5						
467				100	95-100		35-70		10-30	0-5				
5					100	90-100	20-55	0-10	0-5					
57					100	95-100		25-60		0-10	0-5			
67						100	90-100		20-55	0-10	0-5			
7							100	90-100	40-70	0-15	0-5			
8								100	85-100	10-30	0-10	0-5		
10									100	85-100			10-30	
2A**				100			52-100		36-70	24-50	16-38*	10-30		
OGS**				100			52-100		36-65	8-40		0-12		

* Applies only for bituminous mixtures.
** PENNDOT Number
*** For 75 µm (No. 200), see Table D.

Note A: A combination of No. 7 and No. 5 may be substituted for No. 57, provided that not more than 50% or less than 30% of the combination is No. 7 size.

Note B: Provide No. OGS material that has a minimum average coefficient of uniformity of 4.0. The average coefficient of uniformity is defined as the average of the sublots within each lot. Determine the coefficient of uniformity according to PTM No. 149 each time the gradation is determined. The required minimum coefficient of uniformity for individual samples is 3.5. If the coefficient of uniformity of any sample falls below 3.5, reject the lot. Do not use the coefficient of uniformity in the multiple deficiency formula.

2.7 Common Fill Materials: Subsoil; either reused or imported soil material free of soil masses larger than 6 inches, rocks larger than 3 inches, roots, organic material and debris. No more than 5% by weight of fill material shall consist of rocks.

PART 3 EXECUTION

3.1 PAVEMENT REMOVAL

A. Remove pavement, curbing, and sidewalk as indicated on the Drawings. Saw cut or mill areas to be removed, to provide a clean cut in the pavement.

B. Cement concrete pavements shall be opened by sawing. Asphaltic concrete pavements shall be cut to neat straight lines with channeling machines or other methods to provide a clean cut in the pavement and base without undue shattering.

C. All debris and material resulting from the removal shall be removed from the site and legally disposed of by the Contractor.

3.2 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Identify all utilities and mark locations.

C. Maintain and protect existing utilities which pass through the work area and are to remain in service.

D. Notify utility companies to remove and/or relocate utilities as required.

E. Upon discovery of unknown utilities or concealed conditions, discontinue Work in the affected area and notify the ENGINEER.

F. Implement all procedures as required by the sediment and erosion control plan. Temporary seeding shall be employed on all areas that are disturbed and remain exposed for more than twenty days.

3.3 ROCK EXCAVATION

A. The CONTRACTOR shall excavate and remove rock by mechanical methods to the dimensions and elevations as required for the proposed construction.

B. If rock cannot be excavated by suitable mechanical means, the CONTRACTOR shall:

1. Notify the ENGINEER and the OWNER in writing;

2. If basting is permitted by the ENGINEER and OWNER, obtain all necessary permits for explosive methods,

3. If basting is permitted by the ENGINEER and OWNER, advise owners of adjacent buildings or structures in writing of intended blasting operations,

4. If basting is permitted by the ENGINEER and OWNER, proceed with rock disintegration under supervision of licensed blaster using charges, delay devices and safety measures as required by the explosives firm engaged for the Work.

C. Cut away rock at excavation bottom to form a sound level bearing surface. Shattered, fractured or otherwise unsound shale layers shall be removed.

D. All excavated material shall be removed from the site and legally disposed of by the CONTRACTOR.

3.4 EXCAVATION

A. The CONTRACTOR shall perform all excavation required to construct all facilities, structures and Work incidental thereto. Excavation shall extend a sufficient distance to allow working space and inspection, except where concrete is to be deposited directly against excavated surfaces.

B. All loose material shall be removed from excavations, and bottoms shall be carefully leveled to grade.

C. None of the above provisions shall be construed to relieve the CONTRACTOR of his responsibility to make a careful personal examination of the site in order to satisfy himself as to the nature and location of the Work required, the conformation of the ground, the soil and rock conditions and the character, quality, and quantity of the materials.

D. Excavated materials to be used for backfill or other purposes shall be piled away from the edge of the excavated area a sufficient distance to prevent overloading the bank, and graded in such a way as to prevent surface water from entering the excavated area. Excess material from excavation not suitable nor required for backfill or other purposes shall be hauled from the site.

E. Excavations shall not be carried below existing structure foundations until underpinning and/or shoring, to be performed by the CONTRACTOR, has been completed.

F. Do not excavate to full depth when rain or freezing conditions are imminent. Where soil surfaces are damaged by water, mud, or otherwise disturbed, all loose mud or other materials shall be removed and the surface regraded.

G. The CONTRACTOR shall furnish adequate advance notification to the ENGINEER of times when footing excavations are to be completed so that the bearing quality of bottoms may be inspected and/or tested before forms are constructed or concrete placed.

H. If suitable bearing is not encountered at the depth indicated on the Drawings for foundations, the CONTRACTOR shall immediately notify the ENGINEER. The CONTRACTOR shall not proceed further until instructions are given and necessary measurements made for the purpose of establishing additional volume of excavation.

I. The CONTRACTOR shall pump or otherwise remove any water which may be found in the excavation, and he shall provide drainage ditches, underdrains, flumes, well points, pumping equipment or other materials as necessary to keep the excavation free of water so that all required Work can be done in the dry.

J. The CONTRACTOR shall shore, brace, and use sheet piling as necessary to prevent caving in accordance with Federal and State laws and codes. Cover holes and trenches when work is not in progress. Fence or barricade sharp changes in plane of more than 3 feet in height. Protect persons from injury and property from damage. The CONTRACTOR shall satisfactorily repair or remove and replace work that has been damaged due to failure to provide adequate support or through negligence or fault of the CONTRACTOR in any other manner. The CONTRACTOR shall remove shoring, sheet piling and temporary items as work progresses, and shall not leave temporary wood in concrete, masonry, or earth fill.

3.5 SUBGRADE PREPARATION

A. After excavating and/or stripping topsoil in the areas of buildings, roads and other structures, the existing subgrade shall be proofrolled with at least ten complete coverages of a 10 ton capacity roller, to obtain a firm unyielding subgrade. The CONTRACTOR shall notify the ENGINEER at least seventy-two hours in advance of the proofrolling operation, so that a representative can observe the process.

B. If during the proofrolling operations any soft, unstable or yielding areas are found, they shall be overexcavated to a depth and width as ordered by the ENGINEER and backfilled with select fill compacted to an in-place density of ninety-five percent of the maximum dry density or otherwise stabilized or modified as directed by the ENGINEER.

3.6 FILLING, BACKFILLING AND ROUGH GRADING

A. Filling and backfilling shall be performed to the rough grades and compaction percentages as indicated in the schedule below by placing and compacting select fill or approved common fill in continuous layers not exceeding 8 inches loose depth.

B. The fill or backfill material shall be maintained at $\pm$3% of the optimum moisture content, as determined by laboratory testing, to insure proper compaction.

C. No backfill shall be placed on frozen, wet, spongy or unstable subgrade surface. No frozen material shall be used for fill.

D. The CONTRACTOR shall employ a placement method to avoid damage to foundation walls, dampproofing, buried piping and accessories.

E. Horizontally bench existing slopes greater than 1 to 4, to key placed fill material to slope to provide firm bearing.

END OF SECTION 31 23 00

SECTION 31 23 33 – TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparation
2. Cutting paved surfaces
3. Blasting
4. Trench excavation
5. Support of excavation
6. Control of excavated material
7. Dewatering
8. Pipe Laying
9. Backfilling trenches
10. Disposal of Excavated Material

1.2 APPLICABILITY

The specifications provided in this section shall apply only to the construction items outside of the building footprint.

1.3 DEFINITIONS

Section not used.

1.4 SUBMITTALS

A. Certificates:

1. Submit certification attesting that the composition analysis of pipe bedding and select material stone backfill materials meet specification requirements.

2. Submit certified compaction testing results from the soils testing laboratory.

B. Compaction Equipment List:

1. Submit a list of all equipment to be utilized for compaction, including manufacturer's lift thickness limitations for prior approval of the ENGINEER.

1.5 QUALITY ASSURANCE

A. Testing Agency:

1. Compaction testing shall be performed by a Soils Testing Laboratory engaged and paid for by the CONTRACTOR and approved by the Engineer.

B. Compaction Testing:

1. Conduct compaction tests at locations as directed by the ENGINEER during backfilling operations.

2. Determine compaction in areas other than state highways and shoulders by the testing procedure contained in ASTM D698 or ASTM D2922.

1.6 DELIVERY, STORAGE, AND HANDLING

Section not used.

1.7 JOB CONDITIONS

A. Classification of Excavation:

1. All excavation work performed under these Specifications is unclassified, and includes excavation and removal of all soil, shale, rock, boulders, fill, and all other materials encountered of whatever nature.

B. Compaction of Backfill:

1. The degree of compaction required at all locations is to follow PennDOT requirements.

C. Protection of Existing Utilities and Structures:

1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 38 of the General Assembly of Pennsylvania, advise each Utility at least 3 working days in advance of intent to excavate, do demolition work or use explosives and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines. Utilities and other underground and above ground facilities which are not included within the provisions of Act 38, Underground Utilities Act, shall be recognized and avoided.

2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.

3. Immediately report to the Utility and the ENGINEER any break, leak or other damage to the lines or protective coatings made or discovered during the Work and immediately alert the occupants of premises of any emergency created or discovered.

4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

PART 2 PRODUCTS

2.1 PIPE BEDDING MATERIAL

A. Gravity Sanitary Sewer Pipe, Sanitary Sewer Laterals, Force Mains, Pressure Sanitary Sewer Pipe, Water Mains, and Underground Rain Leader Systems.

1. AASHTO No. 8 crushed stone or gravel aggregate, Table C, Section 703.2, Publication 408 Specifications. Do not use slag or cinders. AASHTO No. 8 aggregate shall be placed a minimum of 6" below the bottom of the pipe.

B. Gravity Storm Sewers – Crushed stone or gravel aggregate conforming to AASHTO No. 57, Type 2A coarse aggregate, Section 703, Publication 408 Specifications.

2.2 BACKFILL MATERIAL

A. Gravity Sanitary Sewer Pipe, Sanitary Sewer Laterals, Force Mains, Pressure Sanitary Sewer Pipe, Water Mains, and Underground Rain Leader Systems.

1. Suitable Backfill Material (State highways, municipal Streets, access drives, parking lots, and all other paved surfaces and/or shoulders, or areas proposed to be paved):

a. AASHTO No. 8 crushed stone or gravel aggregate around pipe and to an elevation one (1) foot above top of pipe, thoroughly filling the pipe haunch void area.

b. Crushed stone aggregate conforming to PENNDOT 2A Aggregate from one (1) foot above pipe to surface. This PENNDOT 2A Aggregate backfill material shall be considered as the standard method for trench backfill.

c. Crushed stone aggregate conforming to AASHTO Select Granular Material (2RC), Section 703.3, Publication 408 Specifications, where required by the specific project, to surface.

2. Suitable Backfill Material (Other than state highways, paved surfaces and/or shoulders, or areas proposed to be paved):

a. From top of bedding material to 24" above pipe:

1. AASHTO No. 8 crushed stone or gravel aggregate around pipe and to an elevation two (2) feet above top of pipe, thoroughly filling the pipe haunch void area.

b. From 24" above pipe to subgrade elevation:

1. PennDOT No. 2A crushed stone or gravel aggregate or material excavated from the trench if free of stones larger than 3" in size and free of wet, frozen, or organic materials where approved by the County.

B. Storm Sewer Pipe

1. Polyvinyl Chloride (PVC) Schedule 40 Pipe

a. Suitable Backfill Material (existing and proposed paved areas):

1. AASHTO No. 8 crushed stone or gravel aggregate around pipe and to an elevation one (1) foot above top of pipe, thoroughly filling the pipe haunch void area.

2. Crushed stone aggregate conforming to PennDOT 2A Aggregate from one (1) foot above pipe to subgrade elevation. This PennDOT 2A Aggregate backfill material shall be considered as the standard method for trench backfill.

b. Suitable Backfill Material (areas outside of existing and proposed paved areas):

1. AASHTO No. 8 crushed stone or gravel aggregate around pipe and to an elevation one (1) foot above top of pipe, thoroughly filling the pipe haunch void area.

2. Crushed stone aggregate conforming to PennDOT 2A Aggregate from one (1) foot above pipe to subgrade elevation. This PennDOT 2A Aggregate backfill material shall be considered as the standard method for trench backfill. At the direction of the engineer, select soil backfill may be used in lieu of PennDOT 2A Aggregate.

C. Utilities By Others

1. Utilities other than the County (gas, electric, etc.). The following specifications shall address all backfill and compaction requirements mandated by the County for utilities owned and maintained “by others” whenever a utility pipe/conduit or other material is installed underground within the County’s public right-of-way, the following backfill and compaction requirements shall be followed.

a. Bedding: In accordance with the appropriate Utility specifications.

b. Aggregate cover: In accordance with the appropriate Utility specifications.

c. Remaining backfill to subgrade (within existing and proposed paved areas):

1. From top of specified utility cover material over pipe/conduit to proposed subgrade, use PennDOT 2A Aggregate stone placed in eight-inch (8") compacted lifts.

2. NOTE: For lifts greater than eight inches (8"), written authorization must be received from the Engineer and copy of same shall remain on the project site and made available at all times.

d. Remaining backfill to subgrade (in any area not described in 3. above).

1. PennDOT 2A Aggregate stone up to one foot (1') over top of pipe/conduit full width of trench and placed in eight-inch (8") compacted lifts.

2. From one foot (1') over top of pipe to proposed subgrade, suitable, select fill having no rock greater than eight inches in diameter and as approved by the Engineer and placed in well-compacted eight-inch (8") lifts.

3. Utility crossing and other open excavations after stone aggregate and/or pavement base course installation:

In new developments, the above-referenced backfill and compaction specifications shall apply prior to placement and construction of the new stone aggregate subbase and/or bituminous pavement base course. However, for any utility trench excavated in the aggregate subbase and/or bituminous pavement base course, the entire trench backfill shall be:

e. PennDOT 2A Aggregate stone placed in eight inch (8") compacted lifts from top of utility up to subgrade; AND,

f. In kind replacement of the stone subbase and bituminous base course with a one foot (1') cutback from all edges of the trench on the bituminous base course.

D. Concrete for Thrust Blocks:

1. Concrete for thrust blocks shall be ready mixed concrete and shall not be mixed on site without the express permission of the ENGINEER. Concrete shall have a minimum strength of 3,000 PSI AT 28 DAYS.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. Protect plant life, lawns, trees and other features remaining as a portion of final landscaping.

C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

D. Maintain and protect above and below grade utilities which are to remain.

3.2 CUTTING PAVED SURFACES

A. Where installation of pipelines, miscellaneous structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench.

B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

C. The requirement for neat line cuts, in other than state highways, may be waived if the final paving restoration indicates overlay beyond the trench width.

3.3 BLASTING (IF PERMITTED BY ENGINEER AND OWNER)

A. Blasting will be permitted upon the written approval of the ENGINEER, provided the municipal ordinances permit blasting, except in areas where the proximity of structures, underground facilities, or public safety preclude the use of explosives. Nothing in this section shall relieve the CONTRACTOR of his responsibilities for damages to persons or property, nor shall it result in any responsibility to the OWNER or the ENGINEER.

B. Blasting work shall be supervised and directly controlled by licensed and experienced personnel and performed in conformance with applicable Federal, State and local codes.

C. Only small amounts of explosives shall be kept at any one place and shall be kept under lock. The key shall be entrusted only to a responsible person. Caps and detonators shall not be kept in the same place as explosives. No explosives bunkers will be allowed.

3.4 TRENCH EXCAVATION

A. Depth of Excavation:

1. Pressure Pipelines:

a. Excavate trenches to the minimum depth for placement of pipe bedding material necessary and to provide 4’-0" from the top of the pipe to the finished ground elevation, except where specific depths are otherwise shown on the drawings.

2. Gravity Pipelines:

a. Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.

3. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle or pipe sills can be placed.
If no concrete cradle or pipe sills are to be installed, refill the trench to required pipeline subgrade with pipe trench subgrade stabilization material (AASHTO No. 1 crushed aggregate unless otherwise specified) and proceed with pipe bedding, pipe laying procedures.

4. Where rock is encountered in the trench bottom, remove the rock to the depths as shown on Standard Details and backfill to the required pipeline grade with bedding material or concrete as shown.

5. Where the CONTRACTOR, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material at CONTRACTOR cost.

B. Width of Excavation:

1. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe bedding and trench backfill around the pipe, but not less than 16" plus the pipe outside diameter. See Standard Details for trench width limits.

2. Shape trench walls completely vertical from trench bottom to at least 2' above the top of the pipe.

3. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.

C. Length of Open Trench:

1. Do not advance trenching operations more than two hundred (200) feet ahead of completed pipeline, except as specified in a State Highway Occupancy Permit.

2. Trench excavation shall be fully completed, except for the forming of the trench sub-grade, at least twenty (20) feet in advance of the pipe placement, and shall be kept free from obstructions; except that at the close of the workday, or at the discontinuance of WORK, the pipe laying may be completed to within five (5) feet of the end of the opened trench. The amount of pipe laid in advance of backfilling shall not exceed one hundred (100) feet. In State Highways, all trenches in the cartway must be closed and not more than twenty (20) feet of trench may remain open in shoulder areas at the close of the workday or discontinuance of Work. If any permit imposes different restrictions, comply with the permit.

3. The ENGINEER may, at any time, require the backfilling of open trenches over completed pipelines; and the CONTRACTOR shall have no claim for compensation even if, to accomplish said backfilling, excavation or other Work at any place must be temporarily discontinued.

4. If Work is discontinued on any trench, except by order of the ENGINEER, and the excavation remains open for an unreasonable length of time, in the opinion of the ENGINEER, the CONTRACTOR shall backfill such trench, if so directed by the ENGINEER.

5. Open trenches shall be covered with steel plating at the end of each workday. In the alternative, the trench shall be backfilled and reopened on the following workday.

3.5 SUPPORT OF EXCAVATION

A. Support excavations with sheeting, shoring, and bracing or a "trench box" as required to comply with Federal and State laws and codes.

B. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the CONTRACTOR in any other manner, shall be repaired at the CONTRACTOR's expense.

C. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the ENGINEER.

3.6 CONTROL OF EXCAVATED MATERIAL

A. Keep the ground surface, within a minimum of 2' of both sides of the excavation free of excavated material.

B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.

C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other

satisfactory facilities for Street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work. Control sedimentation and erosion.

D. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed into, or dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.

E. When it is necessary to haul soft or wet material over Streets, the CONTRACTOR shall provide suitably tight and diapered vehicles, of a pattern approved by the ENGINEER for this purpose.

3.7 DEWATERING

A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the Work.

B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.

C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.

D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.8 PIPE LAYING

A. Provide required pipe bedding placed in accordance with the Drawings as specified.

B. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.9 BACKFILLING TRENCHES

A. After pipe installation and inspection, backfill trenches from trench pipe bedding to 12" above the crown of the pipe with specified backfill material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specific compaction around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material.

B. Compaction and Lift Thickness:

1. Only vibratory compaction equipment approved by the ENGINEER and listed below shall be utilized.

a. Vibratory drum rollers utilizing cleated or sheepsfoot style drums, i.e. RAMEX

style.

b. Hydraulic plate soil compactors (Head Shakers), i.e. Tramac Compactors

c. If existing conditions warrant, other soil compaction equipment may be used when approved by the ENGINEER.

The maximum allowable lift thickness shall be eight (8) inches using the vibratory compaction equipment. When conditions require compaction different from the vibratory equipment specified herein, the maximum allowable lift shall be six (6) inches. If the specified compaction is not obtained, the CONTRACTOR shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compaction.

2. Lift thickness limitations specified for state highways, shoulders, embankments, or special conditions described for any project shall govern over the maximum allowable value of eight (8) inches per lift.

C. Unsuitable Backfill Material:

1. Where the ENGINEER deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with aggregate material stone backfill or suitable foreign backfill material, consistent with the Specifications and Drawings.

3.10 DISPOSAL OF EXCAVATED MATERIAL

A. Excavated material remaining after completion of backfilling shall remain the property of the CONTRACTOR, be removed from the construction area, and be legally disposed.

END OF SECTION 31 23 33

SECTION 32 12 16– PAVING AND RESURFACING

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Bituminous Pavement Reconstruction
   2. Bituminous Overlay
   3. Concrete Curb and Sidewalk Repairs

1.2 DEFINITIONS

Section not used.

1.3 SUBMITTALS

A. Certificates:

   1. Submit certification from bituminous, aggregate, and concrete suppliers attesting that materials conform to PennDOT specifications.

1.4 QUALITY ASSURANCE

A. Referenced Standards:

   1. Pennsylvania Department of Transportation:

      a. Publication 408 Specifications

      b. Publication 27 – Specification for Bituminous Mixtures (Bulletin 27)

      c. Publication 37 – Specification of Bituminous Materials (Bulletin 25)

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle products in accordance with manufacturer’s instructions and any applicable PennDOT specifications.

B. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

C. Provided equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

PART 2 PRODUCTS

2.1 CONCRETE

A. See PennDOT Publication 408 Specifications Section 301.

2.2 BITUMINOUS PAVING MATERIALS AND AGGREGATES

A. Refer to Publication 408 Specifications. All bituminous materials and aggregates used in the paving and resurfacing are designated on the drawings and shall conform to the applicable portions of the Publication 408 Specifications.

PART 3 EXECUTION

3.1 BITUMINOUS PAVEMENT RECONSTRUCTION

A. Trim existing paving to remove damaged areas. Cut straight joint lines and right angle offsets. Remove existing pavements and dispose of at an approved facility.

B. Construct permanent base and surface courses to the required compacted thicknesses shown on the Drawings, and in accordance with Publication 408 Specifications.

C. Maintain permanent paving to the satisfaction of the Engineer and throughout the contract maintenance period. Unless otherwise specified, the maintenance period shall be one year, following final inspection and approval.

D. Schedule of Thicknesses:
   1. PennDOT 2A Course Aggregate, 6” depth.
   2. Superpave Asphalt Mixture, 19.0 mm, WMA, PG64-22, base course 0.0 to 0.3 million ESALs, 2.5” depth.
   3. Superpave Asphalt Mixture, 9.5 mm, WMA, PG64-22, wearing course 0.0 to 0.3 million ESALs, SRL-L, 1.5” depth.

E. Bituminous PG64-22 sealer 12” wide shall be placed on all pavement joints or adjacent to curbs, gutters, utilities and structures. Rubberized sealant materials shall not be used.

3.2 BITUMINOUS OVERLAY

A. Where indicated on the Drawings or directed by the Engineer place a bituminous overlay.

B. Mill off existing 1.5” wearing course from outdoor recreation area and construct in accordance with Section 401, Publication 408 Specifications. Dispose of millings at an approved facility.

3.3 CRACK SEALING

A. Clean and prepare surface, then apply rubberized crack sealer in accordance with the drawings and PennDOT Publication 408, Sections 469 and 705.4(c).

3.4 ASPHALT SEAL COAT

A. Clean and prepare surface, then apply asphalt seal coat in accordance with the drawings and PennDOT Publication 408, Section 470.

3.5 CONCRETE CURB AND SIDEWALK REPAIRS

A. Construct curb and sidewalk as indicated on the Drawings.

B. Construct new curb and sidewalk to the first expansion joint, where applicable. Install expansion joint material.

C. Using PennDOT Class A concrete, construct new curb with a height of 18” with a bottom width of 6”, a top width of 5”, and a reveal of 6”, or as otherwise indicated on the plans. Provide mastic joint sealant, expansion joints, and scored joints as directed by the Engineer.

D. Using PennDOT Class A concrete, and as indicated on the Drawings construct new sidewalk with a thickness of 4” on top of a PennDOT 2B subbase with a thickness of 6”. Provide 6”x6” welded wire mesh between the concrete and the aggregate subbase. Provide mastic joint sealant, expansion joints, and scored joints as directed by the Engineer.

END OF SECTION 32 12 16

SECTION 32 17 23– PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Pavement markings.

1.2 DEFINITIONS

Section not used.

1.3 SUBMITTALS

A. CONTRACTOR shall provide a submittal for the type of paint proposed to be used for the pavement markings.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with applicable sections of PennDOT specifications.

B. Obtain materials from same source throughout.

1.5 DELIVERY, STORAGE, AND HANDLING

Section not used.

PART 2 PRODUCTS

2.1 MATERIALS

A. All materials to be used should meet the requirements of PennDOT specifications for waterborne pavement markings. CONTRACTOR will be responsible for furnishing all required materials.

PART 3 EXECUTION

3.1 INSTALLATION

A. Clean surface and ensure that temperature and other weather conditions comply with manufacturer and PennDOT specifications.

B. Measure as necessary and provide temporary markings for the permanent pavement markings.

C. Install pavement markings per PennDOT specifications.

END OF SECTION 32 17 23

SECTION 32 31 00 – VEHICULAR OVEREHEAD SLIDE GATE OPERATOR

PART 1 GENERAL

1.1 SECTION INCLUDES

A. The work in this section shall include furnishing and installing a sliding gate operator system to allow motorized operation of the gate(s) by pressing the appropriate pushbutton on the control console as shown at the locates(s) on the drawings.

1.2 RELATED SECTIONS:

A. Division 03 00 00 – "Cast-In-Place Concrete".

B. Division 26 00 00 – "Electrical Requirements".

1.3 REFERENCES:

A. UL 325 Gate Operator Requirements (See 2.03 – C - 2)

B. American Welding Society AWS D1.1/D1.1M Structural Welding Code. (See 1.05 – C-3)

C. ASTM F 1083 – Standard Specification for Pipe, Steel, Hop-Dipped Zinc Coated (galvanized) Welded, for Fence Structures. (See 1.05 - C-1)

D. ASCE-7 Wind Load Requirements (See 1.05 – C-4).

1.4 SUBMITTALS:

A. PRODUCT DATA:
1. Provide Manufacturer's catalog cuts with printed specifications and installation instructions.
2. Deliver two copies of operation and maintenance data covering the installed products. Manual to include parts list showing manufacturer's names and part numbers for the gate operator.

B. SHOP DRAWINGS:
1. Supply Shop Drawings showing the relationship of operating systems with gate components, including details of all major components.

C. CERTIFICATIONS:
1. The gate operator shall be in compliance with UL 325 as evidenced by UL listing label attached to gate operator. (See 1.3 – A).

PART 2 PRODUCTS:

2.1 MANUFACTURERS

A. Tymetal Corp.: Slide Gate Operator 225-VSC, Basis of Design

B. Approved Equal

2.2 VEHICULAR OVERHEAD SLIDE GATE OPERATOR

A. The slide gate operator shall open and close cantilever, overhead, or track gates, to provide convenience and security. This model is adapted to function with most accessories including radio controls, electro-mechanical locks, single and three button control stations, digital keypads, coded cards, sensing loops, telephone entry systems, and revenue control equipment. The operator utilizes 480 Volt AC, three phase power. Motor box is 10-gauge galvanized steel with detention grade hinges and paracentric lock.

B. The gate operator shall be UL 325 compliant for Class III and IV.

C. The gate operator includes an APeX Controller with integrated radio receiver, plug-in loop detector capability, surge protection, and easy to read labeling standard.

D. Capacity:
1. The gate operator shall be rated to operate a gate weighing up to 5,000 lbs.

E. Motor Size:
1. The electrical motor shall be 1 HP [480 VAC, Three Phase] as produced by a nationally recognized manufacturer.

F. AC Drive:
1. The variable frequency drive unit shall allow for programmable speeds and programmable soft-start and soft-stop features.

G. Overload Protection:
1. Motor shall be protected against overload by either a thermal or a current sensing overload device.

H. Gear (Box) Reducer:
1. The self-enclosed gear-head gearbox shall be manufactured as a single unit, and shall consist of a hardened steel, machine cut worm and mating bronze gear running in oil bath. The gearbox shall perform the following functions:
   a. Adjustable Clutching Device.
   b. Manual disconnect by crank handle.

I. Gear Box Heater
1. Operator shall include internal gearbox heater and a heater strip for the control box.

J. Drive – Chain:

1. A #50 roller chain shall be utilized. All chain brackets and required attachment hardware shall be supplied.

K. Manual Operation:
1. A crank handle, located at ground level in the motor box, shall provide a two-step emergency procedure for manual operation:
   a. Unlock and open motor-box door.
   b. Fold out handle and crank gate opened or closed.

L. Limits:
1. The operator shall be equipped with an integral limit system, providing accurate settings to control the open and close positions of the gate, and shall not be affected by manual operation or motor removal.

M. Control Circuit:
1. U.L. listed operator shall have 5VDC control signal.

N. Control wiring:
1. The electrical contractor shall supply all exterior control wiring.

O. Audio Alarm:
1. This alarm shall have a dual function.
   a. The first function shall be as a warning prior to gate movement. When the motor control board recognizes a command, this alarm shall be activated three (3) seconds before the motor is energized and the gate begins to move. This shall be continuously activated while the gate is in motion.

P. Main Power Disconnect Switch and Wiring Compartment:
1. When this switch is in the OFF position, the main power shall be disconnected from the Variable Speed Drive, Motor Control Board, and power transformer(s).

Q. Speed:
1. The gate operator speed shall be fully programmable, allowing a standard speed of 1.5 feet per second, adjustable to 2.2’ per second in the field if desired.

R. Transformer:
1. Operators shall have an isolated low voltage (24VDC, 750mA) power supplied to provide power for external control devices (not including external gate lock).

S. Auto Close Timer:
1. The timer provides an automatic closure of the gate from the fully open position, adjustable from 0 to 60 seconds.

T. Master/Slave:
1. Master/Slave or stand-alone capable with programmable setting.

U. Factory Inspection and Testing

1. Manufacturer shall test each operator at factory to assure smooth, quiet operation.
2. Manufacturer shall test all control inputs to ensure proper function.
3. Motor box shall be locked with a detention grade dead bolt. Three (3) keys shall be provided per key code.

2.3 MOTOR HOUSING:

A. Water Resistant Motor Box shall be constructed of 10-gauge galvanized steel and is located at ground level for easy maintenance.

B. Detention Hinges and Tamper Resistance Security Screws shall be used to secure operator enclosure components.

C. Motor Box Lock: Motor box shall be locked with a prison lock. Provide three (3) paracentric keys per key code.

2.4 FUNCTION AND SYSTEM OPERATION

A. Connections for External Entrapment Preventative Sensors:
1. UL Class IV installations (Guarded Application - Constant Pressure): Constant pressure on the pushbutton control (with the gate in site) is required as a primary entrapment protection device to keep the gate in motion. When the push button is released, the gate will stop. The secondary entrapment device shall be the inherent audio alarm.
2. Operation Typical Installation is a Class IV Installation where security is more critical than a UL compliant system. (Push Button Controls by others):
   a. Gate opening is initiated by pressing its OPEN pushbutton. Control devices selected and provided by others.
   b. Gate is closed by pressing the CLOSED button. Control devices selected and provided by others.
   c. A STOP pushbutton, if provided, allows the gate to be stopped in any position.
   d. Gate movement may be reversed in either direction by pushing the appropriate pushbutton. The control system automatically stops the gate, pauses (adjustable time delay to avoid mechanical damage), and then causes the gate to travel in the opposite direction.
   e. Gate movement from the closed position is not possible except by electric or mechanical means.
3. Should a Class III installation be requested, a UL 325 compliant system is available and can be provided by the manufacturer. Class III utilizes Momentary Contact access control devices. Please contact manufacturer for further details and information.

PART 3 EXECUTION:

3.1 INSTALLATION:

A. Final grades and installation conditions shall be examined. Work shall not begin until all unsatisfactory conditions are corrected.

B. Equipment in this section shall be installed in strict accordance with the company's printed instructions unless otherwise shown on the contract drawings.

3.2 PRELIMINARY SYSTEM TEST:

A. Adjustment: The complete system shall be adjusted, and to assure that it is performing properly.

B. The system shall be operated for a period of time long enough to determine whether the system is in suitable condition to conduct the acceptance test.

C. A factory representative from the gate operator manufacturer shall be provided to witness the test and any necessary adjustments, and train facility maintenance staff.

3.3 SYSTEM ACCEPTANCE TEST:

A. Notification: The owner's representative shall be notified at least three working days prior to the test so arrangements can be made to have a facility representative witness the test.

B. Test each system function step by step as summarized in controls specification section.

C. Supply All equipment necessary for system adjustment and testing.