TECHNICAL SPECIFICATIONS MANUAL

IRWIN BOROUGH
BUILDING RENOVATIONS
BOROUGH OF IRWIN, PENNSYLVANIA 15642
WESTMORELAND COUTY

Prepared For:

BOROUGH OF IRWIN
424 MAIN STREET
IRWIN, PA 15642
T: 724-864-3100

PROJECT NO. IRWIN 2025
Contract No. IRWIN 2025-1.1 - General Construction
Contract No. IRWIN 2025-1.2 - Plumbing Construction
Contract No. IRWIN 2025-1.3 - H.V.A.C. Construction
Contract No. IRWIN 2025-1.4 - Electrical Construction
Contract No. IRWIN 2025-1.5 – Asbestos Abatement

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
PITTSBURGH, PENNSYLVANIA

CEC Project 347-133

APRIL 2025

Civil & Environmental Consultants, Inc.

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INVITATION TO BID

On behalf of the **IRWIN BOROUGH (IRWIN), CIVIL & ENVIRONMENTAL CONSULTANTS, INC. (CEC)** will accept sealed Bids for the **IRWIN BOROUGH BUILDING** located at 4242 Main Street, Irwin, PA 15642 in the Borough of Irwin, Westmoreland County, PA, until 9:00 a.m. (prevailing time as determined by the IRWIN date and time stamp clock) on **June 10, 2025** at the following email address (smartizer@cecinc.com). Should the Borough of Irwin approve a bid, it shall be accepted on Monday, June 11, 2025, at 6:00 PM immediately prior to the regularly scheduled Agenda Session Meeting of Council. Said Meeting shall, unless further notice to the contrary is issued, be held in person pursuant to the previously advertised procedures, which are available upon request at the address and telephone number identified below.

Work generally consists of the following:

- Mobilization & Demobilization
- Insurance, Bonds, and Permits
- Work indicated on the project drawings and specifications for interior and exterior renovations
- Contract No. IRWIN 2025-1.1 is for General Construction
- Contract No IRWIN 2025-1.2 is for Plumbing Construction
- Contract No. IRWIN 2025-1.3 is for H.V.A.C. Construction
- Contract No. IRWIN 2025-1.4 is for Electrical Construction
- Contract No. IRWIN 2025-1.5 is for Asbestos Abatement

Bidders can obtain an electronic complete set of the Contract Documents for the project **at www.cecinc.com/projects-for-bid-pittsburgh** starting **May 10, 2020.**

Contract Documents will not be mailed. There will be no exceptions. Questions shall be submitted in writing via email to Civil & Environmental Consultants, Inc. to the attention of: Scott Maritzer, AIA (smaritzer@cecinc.com). **QUESTIONS WILL NOT BE RESPONDED TO AFTER 6:00 P.M. ON MAY 28, 2025.**

Contract documents, including drawings and specifications, will be on file and available for viewing (hard copy or digital depending on location) upon appointment only during normal business hours, at the following office locations:

1. BOROUGH OF IRWIN (Hard Copy) c/o Zachary Kansler
   424 Main Street
   Irwin, PA 15642
   (724) 864-3100

A non-mandatory Pre-Bid Meeting is scheduled for 9:30 a.m. on **MAY 20, 2025** at the project site. Persons planning to attend the pre-bid meeting are requested to contact Scott Maritzer, AIA at Civil & Environmental Consultants, Inc. via email at: (smaritzer@cecinc.com).

A certified check or bank draft, payable to the order of the **BOROUGH OF IRWIN**, negotiable U.S. Government bonds, or a satisfactory bid bond executed by the Bidder and an acceptable surety authorized to do business in the Commonwealth of Pennsylvania, in an amount equal to ten percent (10%) of the total amount bid shall be submitted with each bid.

The successful Bidder will be required to furnish an assurance of completion in the form of satisfactory performance and payment bonds, each in the amount of 100% of the Contract Price and certificate of insurance prior to award of the Contract. The Contractor awarded the Work shall provide construction maintenance securities as outlined in the Supplemental General Conditions of the contract documents.
Notice is hereby given that the successful Bidders shall comply with the following:

1. Contractor agrees to comply with all applicable federal and state statutes and regulations including, but not limited to, the Building Energy Conservation Act, the Steel Products Procurement Act, the Trade Practices Act, the Public Works Contractor's Bond Act of 1967, and the Flood Plain Management Act. The Contractor must also comply with the Americans with Disabilities Act and agrees to minimize pollution and will strictly comply with all applicable related laws and regulations.

2. The Contractor agrees to comply with nondiscrimination/sexual harassment provisions and will include such provisions in all contracts and subcontracts.

3. Contractor must ensure that no contractor or subcontractor is currently under suspension or debarment by the Commonwealth, any state or the federal government.

4. Contractor must actively recruit minority and women's subcontractors or subcontractors with substantial minority representation among their employees.

5. Contractor and its subcontractors shall furnish progress reports, status reports, project account statements, certificates, approvals, etc.

The Borough of Irwin reserves the right to reject any or all bids, to waive any informalities in the bidding, or to advertise for new proposals, if in the judgment of the Borough of Irwin, it is in their best interest.

No bidder may withdraw a bid within ninety (90) days after the actual date of opening thereof. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the Borough of Irwin and the Bidder.

Irwin Borough Solicitor

_____

Zachary J. Kansler, Solicitor

SECTION 002113 - INSTRUCTIONS TO BIDDER

002113.1 DEFINED TERMS

1.1 The term "Bidder" means one who directly submits a Bid, as distinct from a sub-Bidder, who submits a Bid to a Bidder. The term "Successful Bidder" means the lowest, responsible Bidder to whom Owner (on the basis of Engineer's evaluation as hereinafter provided) makes an award. The term "Bid Document" includes the Invitation for Bid, Instructions to Bidder, Technical Specifications, Contract, Bid Documents, Bid Drawings, and all Addenda issued prior to receipt of Bid.

1.2 Other terms used in the Bid Documents and not defined elsewhere have the following meanings which are applicable to both the singular and plural thereof:

- Owner
  Borough of Irwin
  424 Main Street,
  Irwin, PA 15642
  Contact Person: Zachary J. Kansler, esq.

- Architect/Engineer
  Civil & Environmental Consultants, Inc.
  700 Cherrington Parkway
  Moon Township, PA 15108
  Contact Person: Scott Maritzer, AIA

- Contractor
  The Contractor is the company responsible for performing all construction activities outlined on and in the Bid Drawings and Technical Specifications. The Contractor is ultimately responsible for the quality of the finished product.

002113.2 COPIES OF BID DOCUMENTS

2.1 A complete set of Bid Documents must be used in preparing Bid; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.

2.2 Owner and Engineer in making copies of Bid Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

002113.3 RECEIPT AND OPENING OF BID PROPOSALS

3.1 Bid shall be submitted to the mailing address indicated in the Invitation for Bid.

3.2 The time scheduled for the receipt of proposals shall be in accordance with the Invitation for Bid. After the proposals have been checked and examined, but until the actual award and execution of a Contract, the Owner reserves all its rights with respect to the rejection of bids.

002113.4 PREPARATION OF BID PROPOSAL

4.1 Various forms are included in this bound volume of Bid Documents. The Bidder is required to use the forms and submit the complete proposal intact to the Owner. All blank spaces must be filled in as noted in ink or type. Proposals must give the prices proposed both in words (where noted) and figures with amounts extended and totaled where required. No changes shall be made in the forms or in the items mentioned therein. Erasures and other changes in the Bid must be explained or noted and initialed by the Bidder. In the event of any discrepancy between the written amounts and the figures, the written amounts shall govern.

4.2 The Bidder shall sign his proposal in the blank space provided for this purpose. If the proposal is made by a partnership or corporation, the name and address of the partnership or corporation shall be indicated, together with the names and addresses of the partners or officers. If the proposal is made by a partnership, it must be acknowledged by one of the partners; if made by a corporation, by one of the officers.

4.3 Bidder shall furnish with his Bid Proposal the following Bid Proposal Documents:

- Bid Form Price Total (Included with this Bid Document);
- Bid Form Affidavit (Included with this Bid Document);
- Bid Form (Included with this Bid Document);
- Notice to Prime/Subcontractor Form (Included with this Bid Document);
- Award Verification for Prime/Subcontractors – PL3/PL4 (Included with this Bid Document);
- Fringe Benefit Letter (Included with this Bid Document);
- Preliminary Project Schedule (Provided by Bidder);
- Certificate of Insurance (Copy provided by Bidder);
- Fringe Benefit Letter (Included with this Bid Document);
- Notice to Prime/Subcontractors (Included with this Bid Document);

002113.5 OBLIGATION OF BIDDER

5.1 At the time of the opening of Bids, each Bidder will be presumed to have thoroughly and completely inspected the site of the Work, to have read, and to be thoroughly familiar with the Bidding Documents (including all addenda). The failure or omission of any Bidder to receive or examine any form, instrument, or document shall in no way relieve any Bidder from any obligation in respect to his Bid.

5.2 Each Bidder must be fully informed of the conditions relating to the construction and labor under which the Work will be performed, including the provisions of the Pennsylvania State Labor Law. Failure to do so will not relieve a successful Bidder of his obligations to furnish all material and labor necessary to carry out the provision of the Contract Documents and to complete the contemplated Work for the consideration set

forth in his Bid. Insofar as is possible, the Contractor in the carrying out of his Work must employ such methods or means as will not cause any interruption of or interference with the daily operations of adjacent properties, the Work of any other Contractor, or the safety or convenience of the public.

002113.6 CONDITIONS OF WORK

6.1 Each Bidder must inform himself fully of the conditions relating to the construction and labor under which the Work will be performed; failure to do so will not relieve a successful Bidder of his obligation to furnish all material and labor necessary to carry out the provisions of the Contract Documents and to complete the contemplated Work for the consideration set forth in his Bid. Each Bidder, in bidding, represents that he relies exclusively upon his own investigations and he makes his Bid with a full knowledge of conditions and the kind, quality, and quantity of Work performed.

002113.7 SUBMISSION OF BID PROPOSALS

7.1 Bid Proposals must be submitted no later than the time specified in the Invitation for Bid or as otherwise directed by the Owner, unless the time for the opening of proposals has been postponed.

7.2 Bid Proposals must be addressed to the Borough of Irwin as noted in the Invitation to Bid.

002113.8 SUBCONTRACTORS

8.1 Contractor agrees to bind specifically every Subcontractor to the applicable terms and conditions of the Bid Documents for the Benefit of Owner and/or Engineer.

8.2 Contractor shall be fully responsible for all acts and omissions by them and of persons and organizations for whose acts, any of them, may be liable to the same extent that he is responsible for the acts and omissions of persons directly employed by him.

8.3 The Bidder is specifically advised that any person, firm, or other party to whom it is proposed to award a Subcontract under this Contract must be acceptable to the Owner and/or Engineer, and the approval of the proposed Subcontract award cannot be given by the Owner and/or Engineer unless and until the successful Bidder submits all information and evidence to the Owner and/or Engineer regarding the proposed Subcontractor as may be required.

002113.9 WITHDRAWAL OF BID PROPOSALS

9.1 Any proposal may be withdrawn by the Bidder prior to the scheduled time for the receipt of Bids or authorized postponement thereof provided the Bidder's written request for withdrawal is delivered to the Owner and/or Engineer before the proposals are opened. No Bidder may withdraw his proposal after the actual opening thereof. A proposal which has been withdrawn will be returned to the Bidder unopened at the time of the opening of the other proposals.

002113.10 BASIS OF AWARD

10.1 The Contract will be awarded to that responsible Bidder per contract as determined by the Owner and/or Engineer in its sole discretion whose Bid Price (including accepted add alternates) is the lowest number of dollars and who has demonstrated the ability to perform this type of work, unless the proposals are rejected.

10.2 In the event there is a discrepancy between the prices written in words and written in figures, the prices written in words shall govern.

10.3 The Owner and/or Engineer will not be bound by the award, nor shall any Work be performed on account of the proposed Contract until the Contract has been fully executed, delivered, and approved.

002113.11 QUALIFICATIONS OF BIDDERS

11.1 The Owner and/or Engineer may make such investigation as it deems necessary to determine the ability of the Bidder to perform the Work, and the Bidder shall furnish to the Owner and/or Engineer all such information and data for this purpose as may be needed. The Owner and/or Engineer reserves the right to reject any proposal if the evidence submitted by or investigation of such Bidder fails to satisfy the Owner and/or Engineer that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein or has previously failed to properly perform or complete on time any Contract.

002113.12 RIGHT TO REJECT BID PROPOSALS

12.1 The Owner and/or Engineer reserves the right to reject any or all proposals or to accept the proposal that in its judgment will be for the best interests of the Owner and/or Engineer. Any proposal which contains any omissions, alterations of forms, additions, or alternates not called for, or any qualifications, erasures, or corrections to conform to the requirements stated herein may be disregarded and rejected as improper, except that the Owner and/or Engineer may waive any defects or irregularities. Any proposals which are submitted or received after the scheduled closing time for the receipt of proposals will be rejected and returned without being opened.

12.2 When two or more Bids are equal, the Owner and/or Engineer reserves the right to select the Contractor in its sole discretion.

002113.13 REQUIREMENTS OF BONDS

13.1 A 10 percent Bid Bond or Certified Check is required for this project.

13.2 The successful Contractor shall provide a surety bond, acceptable to the Borough of Irwin for the faithful performance of the contract, and shall furnish a similar labor and materialman’s bond. The amount of each bond shall be indicated by the sum total from comparison of bids.

002113.14 INSURANCE

14.1 The Contractor shall maintain, in force, during the performance of the Work all insurance policies as described in the Contract.

14.2 Certificate of Insurance

The Contractor shall submit with the signed Contract two (2) copies of the "Certificate of Insurance," a copy of which is attached to these general specifications. The certificates are to be completed in each and every category by the Contractor's insurance company(s) and signed by an authorized agent(s) of the insurance company(s). The Contractor shall not commence any work under this Contract until such "Certificate of Insurance" is in the hands of and approved by the Borough of Irwin.

14.3 Workmen's Compensation Insurance

14.3.1 The Contractor shall carry Workmen's Compensation insurance during the life of the Contract to insure his statutory liability to his employees in the state or states in which the work under this Contract is to be performed, plus $100,000 Employer's Liability coverage, and in case any work is sublet, the Contractor's shall require the subcontractor similarly to provide Workmen's Compensation Insurance for all of the latter's employees unless such employees are covered by the protection afforded the Contractor. Where a code number is used on the certificate for this insurance, the title and description of the code number must include the project name and contract number.

14.3.2 In case any class of employees engaged in hazardous work under this contract at the site of the project is not protected under Workmen's. Compensation Statute, the Contractor shall provide adequate insurance coverage for the protection of his employees not otherwise protected.

14.4 Public Liability and Property Damage Insurance

14.4.1 The Contractor shall take out and maintain, during the life of this contract, sufficient comprehensive public liability and property damage insurance as will protect him and any subcontractor performing work covered by this contract, from claims for damages for personal injury, including accidental death, as well as from claims for property damages, which may arise from operations under this contract whether such operations be by himself or by any subcontractor or by anyone directly or indirectly employed by either of them.

14.4.2 The property damage insurance shall cover both above ground and underground structures. Property Damage Liability coverage is to include C (collapse) U (underground) X (explosion) hazard. Insurance policies and certificates of same shall state in words that the coverage is "for the installation of streetscape improvements and shall include any underground structure damage." The amounts of such insurances shall be as follows.

14.4.3 Comprehensive General Liability and Property Damage: The Contractor shall carry the Comprehensive form of General Liability and Property Damage Insurance during the life of the Contract covering all risks itemized in the form for "Certificate of Insurance" provided for in this Contract. The limits shall be not less than $1,000,000 Combined Single Limit.

14.4.4 The Contractor shall likewise take out and maintain either as separate policies or as a coverage included in said Public Liability and Property Damage Insurance during the life of this contract, similar Public Liability and Property Damage Insurance in similar amounts in favor of the Bourgh of Irwin and any

Municipality or Political sub-division within the bounds of which the contract work is to performed.

14.4.5 Comprehensive Automobile Liability and Property Damage: The Contractor shall carry the Comprehensive form of Automobile Liability and Property Damage Insurance during the life of the Contract covering all risks itemized in the form for "Certificate of Insurance" provided for in this Contract and (a) Contractor's own automotive equipment (b) hired and non-owned vehicles. The limits shall be not less than $1,000,000 Combined Single Limit.

14.4.6 Umbrella and/or Excess Liability: The Contractor shall carry Umbrella and/or Excess Liability Insurance during the life of the Contract covering all risks above the limits shown above. The limit shall be not less than $2,000,000.

002113.15 FAILURE TO EXECUTE CONTRACT

15.1 If the successful Bidder shall fail to execute the Contract, he shall be deemed to have refused to enter into the Contract and to have waived all claim to the Work, and he shall pay the Owner all damages sustained by the Owner and/or Engineer as a consequence of his failure to enter into the Contract including all loss from delay and interference with the Owner and/or Engineer's construction program and the difference between the amount of the successful Bidder's proposal and the amount for which the Owner and/or Engineer may contract with another to perform the Work covered by said proposal, if the latter be in excess of the former.

002113.16 CORRECTIONS, ERRORS, ADDENDA, AND INTERPRETATION

16.1 Correction by erasures or other changes in the Bid Proposal must be explained or noted over the signature of the Bidder.

16.2 If a Bidder finds any omissions, discrepancies, or errors in the Contract Documents or is in doubt as to the meaning of the Contract Drawings and Technical Specifications or other Contract Documents, he should notify the Owner and/or Engineer, who may correct, amend, or clarify such documents by an interpretation. If he fails to notify the Owner and/or Engineer, he will be held rigidly to the Owner and/or Engineer's interpretation of the Contract Drawings and Technical Specifications after the Contract is executed.

16.3 No interpretation of the meaning of the plans, specifications, or other Bid Documents will be made to any Bidder orally. Every request for such interpretation should be in writing, addressed to the Owner and/or Engineer, and to be given consideration must be received at least five (5) days prior to the date fixed for the opening of the Bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be mailed to all prospective Bidders (at the respective addresses furnished for such purpose) not later than three (3) days prior to the date fixed for the opening of Bids. It shall be the Bidder's responsibility to contact the Owner and/or Engineer within this three (3) day period to verify receipt of all addenda issued.

16.4 If the Owner and/or Engineer shall deem any matter arising thereafter of such importance as to require correction, amendment, or clarification, he may postpone the time for the opening of Bids by notifying each prospective Bidder of such postponement by mail, facsimile, or telephone and issue an addendum. Failure of any Bidder to receive any

addendum shall not relieve the Bidder from obligations under his Bid if such addendum is actually sent to the Bidder at the address furnished by him at the time he obtains copies of the Bid Documents. All addenda so issued, whether sent by mail, facsimile, carrier, or obtained in person by Contractor (including representatives) shall become part of the Contract Documents.

16.5 Any information which may be given to Bidders other than by means of the Contract Documents or addenda issued in accordance with the foregoing stipulations is given informally and shall not be used as a basis of a claim against the Owner or Engineer.

002113.17 INDEMNIFICATION

17.1 Contractor shall indemnify and hold harmless the Borough of Irwin, its agents, employees, workmen, and servants from and against all claims, damages, or losses and expenses including Attorney's fees arising out of or resulting from the performance of the work, provided that any such claim, damage, loss or expense (a) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting therefrom and (b) is caused in whole or in part by any negligent act or omission of Contractor, any Subcontractor, or anyone for whose acts of them may be liable, regardless of whether or not it is caused in part by the negligence of a party indemnified hereunder.

17.2 In any and all claims against Borough of Irwin, any of its agents or employees by any employee of the Contractor, Subcontractor, or anyone for whose acts any of them may be liable, the indemnification obligation under subparagraph 17.1 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for Contractor or any Subcontractor under Workmen's Compensation acts, disability benefit acts, or other employee acts.

17.3 Any provision of subparagraph 17.1 in respect of indemnification which is prohibited or unenforceable by law in the State in which the work, or other performance described in this contract, is sited shall be ineffective to the extent of such prohibition or unenforceability, and shall not invalidate the remaining provisions of subparagraph 17.1 or this Agreement.

002113.18 INTENT OF CONTRACT DOCUMENTS

18.1 The Invitation for Bid, Instructions to Bidder, Technical Specifications, the Bid, Bid Drawings, all Addenda, and the Contract, are all part of the Contract Documents. The intent of the Contract Documents is to obtain a complete, constructable, and efficient job. It shall be understood that the Bidder has satisfied himself as to the full requirements of the Contract Documents and has based his Bid Proposal upon such understanding.

002113.19 COMPLIANCE WITH LAWS

19.1 The Bidder's attention is directed to the fact that all applicable federal regulations, state laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

19.2 The Bidder's attention is directed to the requirements for compliance with applicable sections of the Pennsylvania State Labor Law regarding hiring practices and payment of wages.

19.3 Funding for the Contract between the Borough and Bidder/Contractor is partially provided through an Economic Development and Community Development Initiatives Program Grant from the Commonwealth of Pennsylvania, Department of Community and Economic Development, Contract No. C000092921 ("Grant Contract"), attached hereto, marked as Exhibit A, and incorporated by reference herein. This grant contract has certain provisions that extend to contactors of the Borough. Bidder certifies for itself that it has no tax liabilities or other Commonwealth obligations, that its obligations are ongoing and has the obligation to notify the Borough if it becomes delinquent in the payment of taxes or other Commonwealth obligations or if it or any of its subcontractors become suspended or debarred by the Commonwealth, federal government, or any other state or governmental entity. Such notification shall be made within 15 days of the date of suspension or debarment. Bidder shall reimburse the Commonwealth for the reasonable costs of investigations incurred by the Office of State Inspector General for investigations of **Bidder's compliance** with the terms of this agreement or any agreement with the Commonwealth **that results in the suspension or debarment of Bidder**. Bidder acknowledges that as a subcontractor of a grant disbursing Commonwealth grant funds, it must comply with Contracting Requirements, as located in in Grant Contract Article V subsections (b)(4) "Grantee Integrity" Provisions, (b)(5) "Contractor Responsibility" Provisions, (b)(6) "Americans with Disabilities" Provisions, (b)(11) "Worker Protection and Investment" Provisions", (d) "Anti-Pollution Regulations", (e) Prohibition of Illegal Alien Labor on Assisted Projects Act" Provisions, the conflicts of interests provisions in Article VIII, and any and all other requirements that extend to contractors of the Borough, as Grantee under said Grant.

002113.20 SIGNING OF THE CONTRACT

20.1 The successful Bidder will be required to execute the Contract, post Bonds and deliver the specified Certificates of Insurance to the Owner within (10) days (no other specified time) after posted notice to him. In case the Bidder shall fail to do so, he will be deemed to have abandoned the Contract and the Owner may thereupon re-advertise or otherwise award said Contract, and recover the losses sustained by such abandonment out of the Bidder's Surety or Certified Check.

002113.21 MINIMUM / PREVAILING WAGE RATES

The project will be required to follow the most current Prevailing Wage Rates issued by the Pennsylvania Bureau of Labor Law Compliance.

002113.22 MAINTENANCE BOND

22.1 Upon completion of the Contract, and prior to the final payment, a Maintenance Bond shall be furnished by the Contractor to the Owner as a guarantee against defective workmanship and materials.

22.2 The Maintenance Bond shall be in an amount equal to one hundred percent (100%) of the Final Contract Value, for a period of one year, unless otherwise specified.

002113.23 CHANGES IN THE WORK

23.1 No changes in the work covered by the approved Contract Documents shall be made without having prior written approval of the Owner.

23.2 Without invalidating the Agreement, the Owner may, at any time or from time to time, order additions, deletions or revisions in the work; these will be authorized by Change Orders. Upon receipt of a Change Order, the Contractor will proceed with the work involved. All such work shall be executed under the applicable conditions of the Contract Documents. If any Change Order causes an increase or decrease in the Contract Price, or an extension or shortening of the Contract Time, an equitable adjustment will be made.

23.3 Charges or credits for the work covered by the approved change shall be determined by one or more, or a combination of the following methods:

(a) Unit Bid prices previously approved.
(b) An agreed Lump Sum.
(c) The actual cost of:
    1. Labor, including foremen;
    2. Materials entering permanently into the work;
    3. The Ownership or rental cost of construction plant and equipment during the time of use of the extra work;
    4. Power and consumable supplies for the operation of power equipment;
    5. Insurance;
    6. Social Security and Old Age and Unemployment contributions.

To the cost under (c) there shall be added a fixed fee to be agreed upon but not to exceed fifteen percent (15%) of the estimated cost of the work. The fee shall be compensation to cover the cost of supervision, overhead, bond, profit and any other general expenses.

23.4 The Engineer may authorize minor changes or alterations in the work not involving extra cost and not inconsistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order.

23.5 Additional work performed by the Contractor without authorization of a Change Order will not entitle him to an increase in the Contract Price or an extension of the Contract Time, except in the case of an emergency when the Engineer will authorize any necessary emergency work.

23.6 The Owner will execute any appropriate Change Order prepared by the Engineer covering changes in the work to be performed and work performed in an emergency and any other claim of the Contractor for a change in the Contract Time or the Contract Price which is approved by the Engineer.

23.7 It is the Contractor's responsibility to notify his Surety of any changes affecting the general scope of the work or change in the Contract Price and the amount of the applicable bonds shall be adjusted accordingly. The Contractor will furnish proof of such adjustment to the Owner.

002113.24 <u>WARRANTY AND GUARANTEE, CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK</u>

24.1 The Contractor warrants and guarantees to the OWNER and the Engineer that all materials and equipment will be new unless otherwise specified and that all work will be

of good quality and free from faults or defects and in accordance with the requirements of the Contract Documents and of any inspections, tests or approvals.

24.2 All unsatisfactory work, all faulty or defective work and all work not conforming to the requirements of the Contract Documents or of such inspections, tests or approvals shall be considered defective.

24.3 All defective work, whether or not in place, may be rejected, but prompt notice of all defects shall be given to the Contractor.

24.4 If required by the Engineer, prior to approval of final payment, the Contractor will promptly, without cost to the Owner and as required by the Engineer, either correct any defective work whether or not fabricated, installed or completed, or if the work has been rejected by the Engineer, remove it from the site and replace it with non-defective work.

24.5 If the Contractor does not correct such defective work or remove and replace such rejected work within a reasonable time, all as required by written notice from the Engineer, the Owner may have the deficiency corrected or the rejected work removed and replaced. All direct or indirect costs of such correction or removal and replacement, including compensation for additional professional services shall be paid by the Contractor, and an appropriate Change Order shall be issued deducting all such costs from the Contract Price. The Contractor will also bear the expense of making good all work of others destroyed or damaged by his correction, removal or replacement of his defective work.

24.6 If, after the approval of final payment and prior to the expiration of one (1) year after the date of Substantial Completion or as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, any work is found to be defective the Contractor will, promptly without cost to the Owner and in accordance with the Owner's written instructions, either correct such defective work, or if it has been rejected by the Owner, remove it from the site and replace it with non-defective work.

24.7 If the Contractor does not promptly comply with the terms of such instructions, the Owner may have the defective work corrected or the rejected work removed and replaced. All direct and indirect costs of such removal and replacement, including compensation for additional professional services, will be paid by the Contractor or his Surety.

24.8 If, instead of requiring correction or removal and replacement of defective work, the Owner (and, prior to approval of final payment, also the Engineer) prefers to accept it, he may do so. In such case, if acceptance occurs prior to approval of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including an appropriate reduction in the Contract Price.

002113.25 APPLICATION FOR PAYMENT FOR WORK PERFORMED

25.1 While each work task will be measured in various different units, each task item will be paid for by the unit price for quantities verified by the Engineer, based on satisfactory completion of work as agreed to by the Contractor and the Engineer. The Contractor may submit to the Engineer an application for partial payment for the work he believes has been adequately completed as of the date of the Application so submitted.

25.2 The application shall contain a schedule of the values of the work performed including quantities and appropriate unit prices as set forth in the Contract. The schedule shall be satisfactory in form and substance to the Engineer.

25.3 The Contractor warrants and guarantees that title to all work, materials, and equipment covered by such a payment will have passed to the Owner as a condition of payment; and such material, work, and equipment is free of all liens, claims, security interests and other encumbrances.

25.4 The application for partial payment must be conveyed to the Engineer by the Thursday preceding the first Wednesday of any month. Applications not received by the Engineer on the set Thursday will necessarily have to wait for payment in the following month.

25.5 The Engineer will, within three (3) days after receipt of each application for payment, either indicate in writing his approval of payment, or return the application to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit to the application. The Owner will, upon presentation to him of an approved Application for Payment, pay the Contractor the amount approved by the Engineer by taking the proper legal steps as provided by law.

002113.26 APPROVAL OF PAYMENTS

26.1 The Engineer's approval of any payment requested in an Application for Payment shall constitute a representation by him to the Owner, based on the Engineer's on-site observations of the work in progress as an experienced and qualified design professional and on his review of the Application for Payment and the supporting data, that the work has progressed to the point indicated; that to the best of his knowledge, information and belief, the quality of the work is in accordance with the Contract Documents, and that the Contractor is entitled to payment of the amount approved.

26.2 By approving any such payment, the Engineer shall not thereby be deemed to have represented that he made exhaustive or continuous on-site inspections to check the quality or the quantity of work, or that he has reviewed the means, methods, techniques, sequences, and procedures of construction or that he has made any examination to ascertain how or for what purpose the Contractor has used the monies paid or to be paid on account of the Contract Price. Payments shall be made to the Contractor on the basis of ninety percent (90%) of the approved monthly statement. The Engineer's approval of final payment shall constitute an additional representation by him to the Owner that the conditions precedent to the Contractor's being entitled to final payment has been fulfilled. Payments shall be made as the work progresses. The Borough of Irwin shall pay to the Contractor 90% of the contract price for such completed work, if such completed work is less than 50% of the entire contract. Estimates of work completed after 50% of the total contract shall be paid at 95%. When the entire work has been completed and tested, the Borough of Irwin shall pay to the Contractor the full amount due for the entire work less 5%.

26.3 The Engineer may refuse to approve the whole or any part of any payment if in his opinion he is unable to make such representations to the OWNER. He may also refuse to approve any such payment, or because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously approved, to such extent as may be necessary in his opinion to protect the OWNER from loss because:

(a) The work is defective;
(b) Claims have been filed or there is reasonable evidence indicating the probably filing thereof.
(c) The Contract Price has been reduced because of modifications;
(d) The OWNER has been required to correct defective work, or
(e) Unsatisfactory prosecution of the work, including failure to clean up as required.

002113.27 SUBSTANTIAL COMPLETION

27.1 Substantial Completion is defined as the date certified by the Engineer when the construction of the project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents, so that the project or specified part can be utilized for the purposes for which it was intended, or if there be no such certification, the date when final payment is due.

27.2 All punchlist or minor repair work for this contract shall be completed within 60 days from the substantial completion date established in notice to proceed.

BID FORM PRICE TOTAL

Contract Title: Irwin Borough Building -Building Renovations, Irwin, PA

Contract NO# (indicate 1.1, 1.2, 1.3, 1.4 or 1.5): ___IRWIN 2025_____

Name of Bidder: _____

Address of Bidder: _____

If Bidder is a corporation, list all shareholders owning five percent or more of Bidder's stock.

_____, _____,

_____

If Bidder is a partnership, list all partners.

_____, _____, _____

Pursuant to and in conjunction with the Invitation to Bid and the Instructions to Bidder relating hereto, the undersigned as a Bidder proposes and agrees to furnish and complete at the Site the services specified in the Contract Documents, in the manner therein prescribed and in accordance with all addenda issued by Owner prior to the opening of Bids, for a series of fixed unit and firm lump sum prices which total:

_____(Dollars)
(Written Dollar Amount)

($_____)

All prices are valid for ninety (90) days from the Bid Date. A breakdown of the Bid should be presented on the attached Bid Form.

Alternates:

In accordance with Division 1 Section "Alternates", we agree to add/delete the included in each alternate as follows:

ALTERNATE NO. A1: _____

Add/Deduct
_____(Dollars)
(Written Dollar Amount)

($_____)

ALTERNATE NO. A2: _____

Add/Deduct
_____(Dollars)
(Written Dollar Amount)

($_____)

ALTERNATE NO. A3: _____

Add/Deduct

_____(Dollars)
(Written Dollar Amount)

($_____)

BID FORM AFFIDAVIT

STATE OF __)
) SS:
COUNTY OF _____)

_____, being duly sworn, deposes and says that _____ is _____ (President, Secretary, Treasurer, etc.) of _____ and that the foregoing Bid and all statements therein contained are true and correct.

Sworn to before me this _____ day of _____, 20____.

_____
Notary Public

(SEAL)

My commission expires _____

BID FORM ATTACHMENT NO. 1
BIDDER'S CHECKLIST

Each item is to be initialed to indicate compliance and this form shall be signed and submitted with the Bid Forms.

_____ Bidders Checklist (Attachment No. 1)

_____ Subcontractors/Suppliers List (Attachment No. 2)

_____ Non-Collusion Affidavit (Attachment No. 3)

_____ Bidder Acknowledgment (Attachment No. 4)

_____ Certificate of Insurance (Copy)

Signature of Bidder:

_____

By: _____

Title: _____

Address: _____

_____

_____

Date: _____

BID FORM ATTACHMENT NO. 2
SUBCONTRACTORS/SUPPLIERS LIST

The Contractor shall list the name and address of all subcontractors that will supply material or perform work as part of this Project. Subcontractors shall be subject to the approval of the Owner and Engineer.

SCOPE	NAME AND COMPLETE ADDRESS
1.	
2.	
3.	

SIGNATURE OF BIDDER

_____

By: _____

Title: _____

Address: _____

_____

Date: _____

BID FORM ATTACHMENT NO. 3
NON-COLLUSION AFFIDAVIT

(This Affidavit shall be submitted with the Bid Form.)

STATE OF_____)
) SS:
COUNTY OF_____)

_____ , being first duly sworn, deposes and says that he/she is

_____ of _____
(President, Secretary, Treasurer, etc.)

the party who made the foregoing Bid; that such Bid is genuine and not collusive; that said Bidder did not collude, conspire, connive, or agree, directly or indirectly, with any Bidder or person that such other person should refrain from Bidding, or submit a sham Bid and did not in any manner, directly or indirectly seek by agreement or collusion or communication or conference with any person, to fix the Bid Price of Bidder or any other Bidder, or to fix any overhead, profit, or cost element of said Bid Price, or that of any other Bidder, or to secure any advantage against the Borough of Irwin, or any person interested in the proposed Contract; and that all statements contained in said Bid are true and further, that such Bidder did not, directly or indirectly submit this Bid, or the contents thereof, or divulge information, or data relative thereto to any association or to any member or agent thereof.

Signature of Bidder:

_____

By: _____

Title: _____

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

_____
Notary Public

in and for _____ County, _____.

My commission expires _____, 20 ___.

(SEAL)

BID FORM ATTACHMENT NO. 4
BIDDER ACKNOWLEDGMENT

The Bidder acknowledges, represents, and covenants:

1. That the Bid includes all applicable taxes.

2. That if there are inconsistencies between the Engineer's specifications and the Bidder's Bid, the Engineer's specifications shall control.

3. That it has received Addenda Nos. _____, _____, _____, _____ to the Contract Documents.

4. That this Bid is based upon using qualified local labor for all field work done under the Contract.

5. That it has made a careful examination of the location of the Work, and determined the amount and character of the Work and the equipment and materials necessary to complete the same in compliance with the Contract Documents, and has become acquainted with labor conditions and all other conditions which would affect the Work and shall complete the Work in and under conditions it may encounter or create, without delay or extra cost to the Engineer.

6. That this Bid is, in all respects, fair and is made in good faith, without collusion or fraud.

7. That if written notice of the acceptance of this Bid is mailed, faxed, or delivered to the Bidder within 30 days after the Bid Date, Bidder will, within 10 days after the date of such mailing, faxing, or delivering of such notice, execute and deliver the Contractor Services Agreement.

8. Notwithstanding any entireties or similar clauses contained in any of the Contract Documents, upon Engineer's acceptance of the Bid and the execution of the Contractor Services Agreement by the Engineer and the Bidder, the Contractor shall be bound by all terms and conditions contained in the Contract Documents as defined in the Instructions to Bidder.

Signature of Bidder:_____

By: _____

Title: _____

Address: _____

_____

Date: _____

CONTRACT AGREEMENT

THIS AGREEMENT made this _____ day of _____in the year Two Thousand Twenty Five, by and between _____ hereinafter called the CONTRACTOR and the BOROUGH of IRWIN, hereinafter called IRWIN.

WITNESSETH, that the Contractor, and the IRWIN for the considerations named herein, agree as follows:

ARTICLE I – SCOPE OF WORK – The Contractor shall furnish all of the materials and perform all of the work and do all else necessary to complete the contract work as shown on the drawings and described in the specifications, and shown in or described by all agenda or bulletin thereto, as prepared by IRWIN, acting as provided in these contract documents for Contract No. _____.

_____

_____

_____

_____

_____

and shall do everything required by this agreement and the contract documents.

ARTICLE II – THE CONTRACT SUM

The IRWIN shall pay the Contractor for the performance of the Contract, subject to any addition and/or deductions provided therein, in current funds in accordance with the lump sum bid prices of the bid sheet.

ARTICLE III – COMMENCEMENT OF WORK AND TIME OF COMPLETION

The work to be performed under this contract shall be commenced on or before _____and shall be fully completed within _____ (_____) practical working days from and including said date.

ARTICLE IV – FULL PAYMENT

Full payment for the completed work shall be made in accordance with the provisions of the SPECIFICATIONS.

ARTICLE V – The Contractor will pay for all materials which he is required to furnish hereunder and for all service rendered hereunder in the performance of this contract and it is specifically understood and agreed that any person or corporation furnishing such materials or rendering such service may maintain an action to recover for the same against the obliger in the bond given in connection herewith as though such person or corporation was named therein, provided the action is brought within one year after the time the cause of action accrued.

ARTICLE VI – This agreement and the related specifications, with all of the executed forms therein required, shall constitute the Contract Documents, of _____ pages, including the bid prices and the contract plans of _____ pages or sheets and they are all as fully a part of this contract as if hereto attached or herein repeated.

IN WITNESS WHEREOF, the parties hereto have executed this agreement in counterparts the day and year as above written.

_____

By _____

_____
TITLE

WITNESS:

_____

ATTEST:

_____
SECRETARY

BOROUGH OF IRWIN

By: _____

_____

Title: _____

ATTEST:

_____

Title: _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____ as Principal and _____, of the State of _____, a corporation existing under the laws of the State of _____, and authorized to transact business in the Commonwealth of Pennsylvania, as Surety, are held and firmly bound unto _____, herein after called the OBLIGEE, in the sum of_____ Dollars ($_____) lawful money of the United Stated of America, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Proposal or Bid Dated_____, 20___, for Contract _____.

NOW, THEREFORE, the condition of the Bond shall be such that is the Principal, upon due acceptance of said Proposal and award of a contract to him by the Obligee, shall execute and deliver the Agreement, shall furnish to the Obligee bonds with good and sufficient surety as may be required by the Contract Documents, and shall furnish to the Obligee proper evidence of effectiveness of insurance coverage, respectively, within the time, in the forms and in the amounts, as appropriate, required by the Contract Documents, then this Bond shall be void; otherwise, this Bond shall be and shall remain in full force and effect.

The Principal and the Surety agree to pay to the Obligee the difference between the amount of said Proposal, as accepted by the Obligee, and any higher amount for which the required work shall be contracted for by the Obligee, together with any additional advertising cost~, Engineer's fees, legal fees and any and all other fees and expenses incurred by the Obligee by reason of the failure of the Principal to enter into such Agreement with the Obligee, or to furnish such Bonds, or to furnish evidence of effectiveness of such insurance coverage; Provided, however, that:

(1) the obligation of the Surety shall not exceed the stated principal amount of this Bond; and

(2) if the Obligee should not procure an executed contract with any other persons for the performance of the work contemplated in said Proposal, as accepted by the Obligee, upon the same terms and conditions, other than price, as provided in the Contract Documents, within the period covered by the Contract Document during which no proposals of bidders may be withdrawn, whether because of the lack of other proposals, or because of the inability or refusal of any other bidder to enter into an appropriate contract, or because the cost under any higher proposal would be greater than the Obligee shall determine, In its sole discretion, that it can afford, then the Principal and the Surety agree to pay the Obligee the full amount of this Bond as liquidated damages.

It is the intention of the parties hereto to be legally bound by this instrument.

Signed, sealed and delivered in _____ counterparts this _____ day of _____ 20____.

(INDIVIDUAL PRINCIPALS SIGN HERE)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

In the presence of:

_____

_____

(CORPORATE PRINCIPALS SIGN HERE)

_____ (SEAL)

BY _____

ATTEST:

_____

(SURETY SIGN HERE)

_____

_____

PERFORMANCE/MAINTENANCE BOND

KNOW BY ALL MEN THESE PRESENTS, that we, _____,

as Principal, and _____, as Surety,

are held and firmly bound unto the BOROUGH OF IRWIN (hereinafter called the Obligee), in full and just

sum of _____, DOLLARS (_____) lawful

money of the United States, for the payment of which sum well and truly to be

made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said principal has entered into a certain contract with said Obligee, dated _____, _____ (hereinafter called the Contract) for furnishing and installing the materials required under which contract and all of the contract documents herein referred to for said work shall be deemed a part hereof as fully as it set out therein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the principal shall faithfully perform the contract, or any amendment of extension of, or addition to said contract and during one year guarantee period, on his part, of the time and in the manner therein provided and satisfy all claims and demands incurred in or for the same, or growing out of the same, or for injury or damage to persons or property in the performance thereof, and shall fully indemnify and save harmless the said Obligee from any and all cost and damage which the said Obligee may suffer by reason of failure to do so, and shall fully reimburse and repay the said Obligee any and all outlay and expense which it may incur by reason of such default, then this obligation shall be null and void; otherwise it shall remain in full force and virtue.

The said surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the contract or to the work to be performed thereunder to the specifications accompanying the same shall in any ways affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the contract or to the work or to the specifications.

Signed, sealed and delivered in _____counterparts this _____ day of _____20___.

(INDIVIDUAL PRINCIPALS SIGN HERE)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

In the presence of:

_____

_____

(CORPORATE PRINCIPALS SIGN HERE)

_____ (SEAL)

BY _____

ATTEST:

_____

(SURETY SIGN HERE)

_____

_____

LABOR AND MATERIALS BOND

KNOW ALL MEN BY THESE PRESENTS, that we, _____ as Principal, and _____ as Surety, are held and firmly bound Borough of Irwin (hereinafter called the Obligee), in full and just sum of_____, DOLLARS (_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representatives, successors and assigns, jointly and severally firmly by these presents.

WHEREAS, said principal has entered into a certain contract with said Obligee, dated _____, 20____ hereinafter called the Contract for

_____

_____

_____

_____

which contract and all of the contract documents herein referred to for said work shall be deemed part thereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH that if said principal and all subcontractors to whom any portion of work, provided for in said contract is sublet and all assignees of said Principal and of such subcontractors shall promptly make payments for all labor performed, services rendered and materials furnished in the prosecution of the work provided for in said contract, or in any amendment or extension of or addition to said contract, then the above obligation shall be void, otherwise to remain in full force and effect: PROVIDED, however, that this bond is subject to the following conditions and limitations:

(a) All persons who have performed labor, rendered services, or furnished materials or machinery incident to the performance of the work, etc., provided in the contract on account of any pursuant to which this bond is given, may maintain an action to recover for the same against the Obliger in this bond as though such person was named therein, provided the action accrued.

(b) In no event shall the Surety be liable for a greater sum than the penalty of this bond, or subject to any suit action or proceeding thereon that is instituted later than one year after the complete performance of said contract and final settlement thereof.

(c) As used herein: The term "person" refers to any person, firm or corporation who has furnished materials or machinery to be used on or incorporated in the work or the amendment or extension of or addition to said contract, and/or to any person engaged in the prosecution of the work provided for in said contract or in any amendment or extension of or addition to said contract, who is an agent, servant or employee of the Principal, or of any subcontractor, and also anyone so engaged who performs the work of a laborer or of a mechanic regardless of and contractual relationship between the principal or any subcontractor or any assigned or said Principal or of said subcontractor and such laborer or mechanic, but shall not include office employees not regularly stationed at the site of the work.

The said Surety, for the value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of this contract or to the work to be performed thereunder of the specifications accompanying the same shall in anyway affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration or addition of time, alteration or addition to the terms of the contract or to the work or to the specifications.

Signed, sealed and delivered in _____counterparts this _____ day of _____20__.

(INDIVIDUAL PRINCIPALS SIGN HERE)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

_____ (SEAL)

In the presence of:

_____

_____

(CORPORATE PRINCIPALS SIGN HERE)

_____ (SEAL)

BY _____

ATTEST:

_____

(SURETY SIGN HERE)

_____

_____

DOCUMENT 003119 - EXISTING CONDITION INFORMATION

1.1 EXISTING CONDITION INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. Existing drawings that include information on existing conditions including previous construction at Project site are available for viewing at the office of Owner.

C. Survey information that includes information on existing conditions, prepared by CEC, is available for viewing as part of Drawings or LiDAR scanning.

D. Related Requirements:

1. Document 002113 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

END OF DOCUMENT 003119

DOCUMENT 008000 – GENERAL CONDITIONS

PART 1 - A draft copy of AIA Document A201-2007, "GENERAL CONDITIONS FOR THE CONTRACT FOR CONSTRUCTION - 2007" shall be in effect for the duration of the project. This draft document, its requirements and stipulations, and any additions or deletions to it shall become part of the Contract Documents. The Contractor shall be responsible for legally obtaining and supplying an executed copy of this document for signature by Owner upon notice of award.

END OF DOCUMENT 008000

DOCUMENT 000805 - SUPPLEMENTARY CONDITIONS

The following supplements modify the draft copy of the General Conditions of the Contract for Construction, AIA Document 201-2007. Where a portion of the draft copy of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect. Bidder agrees that submission of a bona fide bid for the work described in the Bidding Documents indicates acceptance of all unaltered and altered portions of the draft General Conditions modified herein and that these requirements and modifications shall become part of final legal and binding Contract.

They are interpreted by Civil & Environmental Consultants, Inc as the property of the BOROUGH OF IRWIN

Any discrepancies in these conditions shall be brought to the attention of the Architect prior to placing bid.

ARTICLE 1 - GENERAL PROVISIONS

1.1 Basic Definitions

1.1.1 **The Contract Documents**; revise the last sentence to read "The Contract Documents do include other documents including the following bidding requirements:

- Instructions to Bidders
- Sample and Draft Forms
- The Contractor’s Bid
- Portions of any addenda related to bidding requirements.

1.1.3 **The Work**; add the following clause:

"1.1.3.1 Temporary facilities, tools and other portions of the work which are not to be delivered to the Owner at or prior to Final Completion shall not be subject to the provisions of subparagraph 2.3 of the General Conditions except to the extent that they may interfere with or otherwise adversely affect the Owner's use of or interest of the Project."

Paragraph 1.1 BASIC DEFINITIONS. To paragraph 1.1.5, THE DRAWINGS, add the following subparagraphs:

1.1.5.1 The Drawings are diagrammatic. Exact slopes, pitches, locations of equipment and points of termination shall be verified by Contractor and approved by owner. This shall include both new work and existing conditions. Should it be found that any system or equipment cannot be installed as shown on the Drawings, the Architect shall be notified in writing before installing or making changes to layout.

1.1.5.2 Contractor shall carefully examine the Contract Drawings and Specifications. If any discrepancies occur between the Drawings or between the Drawings and Specifications, the Contractor shall report such discrepancies to the Architect in writing and obtain written instructions as to the manner in which to proceed. No departures from the Contract Documents shall be made without prior written approval of the Architect.

The following subparagraphs shall be added:

"1.1.9 The Bid

The offer or proposal submitted by the contractor on the forms authorized by law are made part of this agreement. The contractor shall perform the work so prescribed for the amount set forth in said bid.

1.1.10 The Architect/Engineer

The Architect for this project and the work to be done is Civil & Environmental Consultants Inc, 700 Cherrington Parkway, Moon Township, PA 15108.

1.1.11 The Contractor

The Contractor is the entity identified in the agreement and who has executed all the documents and is the entity referenced throughout the General Conditions of the Contract and the Supplemental Conditions.

1.1.12 The Owner

The Owner is “BOROUGH OF IRWIN” for whom the work is to be performed.

1.1.13 Award

The award of the contract will be to the lowest responsible bidder whose qualifications indicate the award will be in the best interest of the Owner and whose proposal complies with all of the prescribed requirements. No notice of award will be given until the Owner has concluded such investigations as it deems necessary to establish the responsibility, qualifications, and financial ability of the bidders to do the work in accordance with the contract documents, bidding documents, and all other documents to the satisfaction of the Owner and the Architect within the time prescribed. Owner reserves the right to reject the bid of any bidder who does not pass such investigation to Owner's satisfaction."

1.2 Correlation and Intent of the Contract Documents; add the following clauses to subparagraph 1.2.1;

1.2.1.1 The term "reasonably inferable" includes work necessary to "provide" work indicated or specified, as defined in Section 014200 - References; that is: furnish and install, complete in place and ready for use.

1.2.1.2 In the case of an inconsistency between Drawings and Specifications or within either Document, not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation.

1.2.1.3 Details referenced to portions of the Work shall apply to other like portions of the Work not otherwise detailed.

1.2.1.4 The Contractor shall request from the Architect interpretation of any apparent discrepancies, conflicts, or omissions in the Specifications and Drawings. Subcontractors shall forward such requests through the Contractor. Such requests, and the Architect's interpretation, shall be in written form; other forms of communications may be used to expedite resolutions of concerns but will not be binding.

1.2.1.4.1 Contractor shall utilize "Request for Information" (RFI) form as described in Section 013100 - Project Management and Coordination.

1.2.1.5 Should either the Owner or Contractor consider that the Architect's interpretations are cause for changes to the Contract Sum or the Contract Time, that party shall either bring such considerations to the attention of the Architect, request a revised interpretation, or shall make a claim in accordance with Article 15 of the General Conditions.

1.4 Interpretation; add the following subparagraph:

1.4.1 Wherever in the Contract Documents an item of work is referred to in the singular number, such references shall apply to as many such items as are required to complete the Work."

ARTICLE 2 – OWNER

Delete subparagraph 2.2.5 and substitute the following:

“2.2.5 The Contractor shall be furnished, free of charge, an electronic copy of the contract documents. Hard copies will not be provided.

2.4 Owner’s Right to Carry Out the Work; delete the first sentence of paragraph 2.4 and substitute the following:

“If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, commence and continue to carry out the Work.”

ARTICLE 3 – CONTRACTOR

3.3 Supervision and Construction Procedures; add the following subparagraph

"3.3.4 The Contractor shall be responsible for coordination of the work of Subcontractors, and for dissemination of relevant communications to affected Subcontractors."

3.4 Labor and Materials; add the following subparagraph:

"3.4.4 The Contractor will be held to be thoroughly familiar with conditions affecting labor in the locale of the Project, including, but not limited to, trade jurisdictions and agreements, incentive and premium time pay, procurement, living and commuting conditions. Contractor shall assume responsibility for costs resulting from his failure to verify conditions affecting his labor."

3.5 Warranty; add the following subparagraphs:

"3.5.2 The Contractor shall, in addition, furnish special warranties required by the Specifications.

3.5.3 The provisions of Article 12 of the General Conditions, and Supplementary Conditions thereto, further define the Contractor's responsibilities relative to general and special warranties."

3.6 Taxes; add the following subparagraphs:

"3.6.1.1 The Owner retains the right to the refund of all such taxes from which it is exempt pursuant to 24 Pa. Stat 7-776 or other law.

3.6.1.2 Contractor will fill out all required paper work, shall assist the Owner as necessary to obtain a refund of sales tax on all materials permanently incorporated into the building or premises, or any other tax paid by Contractor but refundable to Owner. All such claims for tax refund shall be in the name of and for the exclusive benefit of the owner, and any such refund obtained by the Contractor shall become the immediate property and possession of the owner.

3.6.1.3 This provision shall apply to all Contractors and subcontractors and shall be included by Contractor in all of its contracts with subcontractors."

3.9 Superintendent; delete subparagraphs 3.9.2 and 3.9.3 and replace with the following subparagraph as follows:

"3.9.2 Contractors shall, within ten (10) days after signing the Contract, submit the names and resumes of their superintendents. This will include previous work experience, qualifications, and references. Provide names and telephone numbers of references. The superintendent shall be satisfactory to the Architect and Owner in all respects. The Architect and Owner shall have the right to require the Contractor to dismiss from the Project any superintendent whose performance is not satisfactory to the Architect or the Owner. The Contractor shall not replace the superintendent without the prior written consent of the Architect and the Owner."

3.10 Contractor's Construction Schedules; add the following subparagraph:

"3.10.1.1 Schedules shall comply with the requirements of Section 013200 – Construction Progress Documentation"

3.10.2 In the first sentence, delete the word "promptly" and substitute "within 10 days" and delete the word "approval" and substitute "review".

In the second sentence, delete the word "approval" and substitute "review"

"3.10.4 Equipment Manufacturers and Subcontractors:

1. Equipment Manufacturer: Within 30 days after award of Contract and prior to submission of the 2nd Application for Payment, the Contractor shall furnish the Architect with a written list of all proposed equipment or product manufacturers for which product data submittals are required. Include the following data for each product:

    a. Specification section number and paragraph

    b. Equipment description (eg, AHU, Boiler, Pumps, etc)

    c. Equipment Manufacturer, Model Number, and Contract Document Identification Number

2. Submittal of equipment manufacturers list does not negate requirements for submission of product data, shop drawings, samples, quality control, and contract closeout, or compliance with substitution request submittals.

3.10.5 List of Subcontractors:

Subcontractors: Prior to the 2nd Application for Payment, the Contractor shall furnish the Architect with a written list of the names of persons or entities proposed as subcontractors for any portion of the work, along with a description of tasks to be performed by each proposed subcontractor."

3.11 Documents and Samples at the Site

3.11.1 In the first sentence delete the word "approved" and change "submittals" to read "submittals, as specified in Section 013300 – Submittal Procedures."

Delete second sentence and substitute: "Except for samples authorized to be used in the Work, 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. Samples shall be delivered to the Architect upon completion of the Work if requested, and otherwise shall become the property of the Contractor and shall be removed from the site."

Add the following subparagraph to paragraph 3.11:

"3.11.2 Detailed requirements are specified in Section 017700 – Closeout Procedures."

3.12 Shop Drawings, Product Data, and Samples

3.12.7 In the third line, delete the word "approved" and substitute "reviewed"

3.12.8 In the third and eleventh lines, delete the word "approval" and substitute "review"

Add the following subparagraph to 3.12:

"3.12.11 Detailing requirements are specified in Section 013300 – Submittal Procedures and Section 016000 – Product Requirements."

3.14 Cutting and Patching; add the following subparagraph:

"3.14.3 Detailed requirements are specified in Section 017300 – Execution."

3.16 Access to Work; add the following subparagraph:

"3.16.2 The Contractor shall promptly notify the Architect and Owner of the presence of hazardous conditions at the Site, including the start of hazardous operations or the discovery or exposure of hazardous substances."

3.18 Indemnification

Add the following subparagraph:

"3.18.1.1 The Contractor shall indemnify and hold harmless the Owner against any assertion of claims for mechanics' liens by Subcontractors, Sub-subcontractors, or material suppliers and against any assertion of security interests by suppliers of goods or materials.

No provision of this Subparagraph shall give rise to any duties on the part of the Architect not otherwise provided for by the contractor or by law.

In the event that any party is requested but refuse to honor the indemnity obligations hereunder, then the party refusing to honor such requests shall, in addition to all other obligations, pay the cost of bringing any such action, including attorney's fees to the party requesting indemnity."

ARTICLE 4 – ADMINISTRATION OF THE CONTRACT

4.1 Architect

4.1.1 After the words "practicing architecture" add "in Pennsylvania and"

Replace subparagraph 4.1.3 with the following:

"4.1.3 In cases of termination of the employment of the Architect, the Owner shall appoint another Architect whose status under the Contract Documents shall be that of the former Architect."

ARTICLE 5 – SUBCONTRACTORS

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

Delete Subparagraph 5.2.3 in its entirety

5.3 Sub contractual Relations

Add subparagraph 5.3.2 as set forth below:

"5.3.2 Notwithstanding any provision of Subparagraph 5.3.1, any part of the Work performed for the Contractor by a Subcontractor or its Sub-subcontractor shall be pursuant to a written Subcontract between the Contractor and such Subcontractor (or the Subcontractor and its Sub-subcontractor at any tier), which shall be prepared on a form of subcontract satisfactory to the Owner in all respects. Each such subcontract shall contain provisions that:

1. Require that such Work be performed in accordance with the requirements of the Contract Documents;

2. Waive all rights that contracting parties may have against one another, or that the Subcontractor may have against the Owner, for damages caused by fire or other perils covered by the insurance described in the Contract Documents;

3. Require the Subcontractor to carry and maintain insurance coverage in accordance with the Contract Documents, and to file certificates of such coverage with the Contractor;

4. Require the Subcontractor to submit certificates and waivers of liens for work completed by it and its Sub-subcontractors as a condition to the disbursement of the progress payment next due and owing;

5. Require submission to Contractor or Subcontractor, as the case may be, of Applications for Payment in a form supplied by the Owner, together with clearly defined invoices and billings supporting all such applications under each subcontract to which the Contractor is a party;

6. Report, so far as predictable, unit prices and any other feasible formula for use in the determination of costs of changes in the Work;

7. Require each Subcontractor to furnish to the Contractor in a timely fashion all information necessary for the preparation and submission of the reports required herein;"

ARTICLE 6 – CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.2 Mutual Responsibility

6.2.3 Delete and replace with the following:

"6.2.3 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor, excepting, however, Owner, and Architect, who shall not be liable to any Contractor or Subcontractor for claims or damages of a monetary or other nature caused by or arising out of delays contemplated or not contemplated at the signing of the Contract. The sole remedy against the Owner for delays shall be an allowance to a successful claimant of addition of time for completion of work."

Add subparagraph 6.2.6 as set forth below:

"6.2.6 Should the Contractor cause damage to the work or property of any separate contractor, the Contractor shall upon due notice, promptly attempt to settle with such other contractor by agreement, or otherwise to resolve the dispute. If such separate contractor sues or initiates a legal proceeding against the Owner, Architect, on account of any damage alleged to have been caused by the Contractor, the Owner, Architect shall notify the Contractor who shall defend such proceedings at the Contractor's expense, and if any judgment or award against the Owner, Architect arises therefrom the Contractor shall pay or satisfy it and shall reimburse the Owner, Architect for all attorney's fees, court or other legal costs which the Owner, Architect has incurred."

ARTICLE 7 – CHANGES IN THE WORK

7.2 Change Orders

Add the following subparagraphs:

"7.2.2.1 In order to facilitate review of quotations 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 labor, materials, and Subcontracts. There shall be no allowance for small tool usage and/or miscellaneous expendables. 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 be approved without such itemization.

7.2.2 Methods used in determining adjustments to the contract sum shall be one, or a combination, of those listed in 7.3.3"

7.3 Construction Change Directives

7.3.7 In the first sentence, delete the words "a reasonable amount" and change to "an allowance for overhead and profit in accordance with Clauses 7.3.11.1 through 7.3.11.5 below."

Add the following subparagraphs to 7.3:

"7.3.11 In subparagraph 7.3.6 and 7.3.12, the allowance for the combined overhead and profit included in the total cost to the Owner shall be based on the following schedule:

7.3.11.1 For the Contractor, for Work performed by the Contractor's own forces, 10 percent of the cost.

7.3.11.2 For the Contractor, for Work performed by the Contractor's Subcontractor, 5 percent of the amount due the Subcontractor.

7.3.11.3 For each Subcontractor or Sub-subcontractor involved, for Work performed by the Subcontractor's or Sub-subcontractor's own forces, 10 percent of the cost.

7.3.11.4 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, 5 percent of the amount due the Sub-subcontractor.

7.3.11.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

7.3.11.6 Cost itemization shall be submitted as set forth in Subparagraph 7.2.2."

ARTICLE 8 – TIME

8.1 Definitions

Delete subparagraph 8.1.2 and substitute the following:

"8.1.2 The work to be performed under this contract shall commence after required insurance has been obtained and approved and within seven days after execution of a contract between the Owner and Contractor, or upon date of "Notice to Proceed", whichever is sooner."

ARTICLE 9 – PAYMENTS AND COMPLETION

9.2 Schedule of Values

Add the following subparagraph:

"9.2.2 Schedule of Values format and content are specified in Section 012900 – Payment Procedures".

9.3 Applications for Payment

Add the following Clauses:

"9.3.1.3 Applications for Payment requirements and content are specified in Section 012900 – Payment Procedures.

9.3.1.4 Retainage:

To ensure proper performance of the Contract, the Owner shall retain ten (10%) percent of all amounts due the Contractor until the work is substantially completed in accordance with Clause 9.8. When the work is substantially completed, one-half (1/2) of the amount retained by the Owner shall be returned to the Contractor: provided, that the Architect in conjunction with the Owner's Project Representative approves the application for payment and reduction of Retainage, and provided further that the Contractor is making satisfactory progress and there is no specific cause for greater withholding. Payments are

subject to provision of Paragraph 9.6. The Owner shall retain five (5%) percent of all amounts due the Contractor after the work is substantially completed, based on progress payment requests. Provided however, that in the event a dispute arises between the Owner and the Contractor, which dispute is based upon increased costs occasioned by delays or other actions of the Contractor or Subcontractors, additional retainage in the sum of one and one-half (1-1/2) times the amount of any possible liability may be withheld until such time as a final resolution is agreed to by all parties directly or indirectly involved, unless the Contractor causing the additional claim furnishes a bond satisfactory to the Owner to indemnify the Owner against the claim. All monies retained by the Owner may be withheld from the Contractor until substantial completion of the work in the project or until all claims are settled, whichever is the longest time."

9.6 Progress Payments

Add the following Clause to subparagraph 9.6.2:

"9.6.2.1 If a Contract for Overall Construction is awarded, payment for work performed by Subcontractors will, upon certification by Contractor, be paid directly to the Subcontractor in accordance with applicable contracts law."

9.8 Substantial Completion

Add the following subparagraph:

"9.8.3.1 If the Contractor has not completed or corrected all items, whether or not included on the original list, by the time the second inspection is performed by the Architect, all time spent by the Architect subsequent to the second inspection shall be compensated by the Owner at the rates established by the Owner/Architect agreement and such compensation shall be deducted from amounts owed the Contractor.

9.9 Partial Occupancy or Use

9.9.1 In the third sentence after "Contractor shall" insert the words "obtain a Certificate of Occupancy and Certificates of Inspection and similar documents required by authorities having jurisdiction and".

Add the following to Article 9:

ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

10.2 Safety of Persons and Property

Add the following subparagraph to Clause 10.2.2:

"10.2.2.1 The Contractor shall give immediate notice to the Owner and Architect of the onset of any hazardous conditions at the site, which could require the implementation of safety programs or measures by personnel visiting the site."

Add the following subparagraph to Clause 10.2.3:

"10.2.3 The Contractor shall implement a hazard communication program including:

1. The contractor must provide the Owner at the initial job meeting a written hazard communication program which describes how the criteria in 29 CFR 1926 59 (f), (g), and (h) will be met:

2. The aforesaid written hazard communication program must include descriptions as to how labeling and other forms of warning; Material Safety Data Sheets; and employee information and training will be handled;

3. The contractor shall be required, at the initial job site meeting, to provide the Owner with a then current list of hazardous chemicals that will be utilized at the work place. In addition to the list, material safety data sheets must be supplied to the owner:

4. The contractor shall inform the owner in writing of the methods used to inform employees of the hazards associated with non-routine tasks;

5. The contractor that uses or will store hazardous chemicals at the work place shall provide the Owner and all other employers at a site with copies of all Material Safety Data Sheets applicable during work performed at the site and shall routinely inform the Owner and all other parties of any precautionary measures that need to be taken to protect employees during the work place's normal operating conditions and in foreseeable emergencies."

10.2.4 In the first line after the word "methods" insert the words "not prohibited by the Contract Documents".

10.3 Hazardous Materials

10.3.2 In the first and fifth sentences, delete the words "been rendered harmless" and substitute "been removed or rendered harmless or will be removed as part of this project"

Add the following Clauses to Article 10:

"10.5 Construction Safety Policy

10.5.1 In the event the Owner adopts a "Construction Safety Policy" it shall be part of the Contract Documents, and may be reviewed and obtained in the office of the Owner.

10.5.2 The Contractor shall provide adequate protection for parts of the present buildings and their contents and occupants wherever Work under this Contract is performed.

10.6 Administration Policy-Accidents/Incidents

10.6.1 In the event that the Owner adopts a Administration Policy-Accidents/Incidents, policy and procedure for reporting accidents and incidents that take place with any building or on the grounds of the site; the document will be part of the Contract Documents.

10.6.2 All accidents/incidents that occur at this site shall be reported on forms provided by the Owner and filed with Owner.

10.6.3 The referenced document and forms may be reviewed and obtained in the office of the Owner."

ARTICLE 11 – INSURANCE AND BONDS

11.1 Contractor's Liability Insurance

11.1.1.1 Delete the semicolon at end of clause and insert the words ", including private entities performing Work at the site and exempt from the coverage on account of number of employees or occupation, which entities shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for duration of the Project;"

11.1.1.2 Delete period at end of clause and insert the words "or persons or entities excluded by statue from the requirements of clause 11.1.1.1 but required by the Contract Documents to provide the insurance required by the clause;"

Add the following subparagraphs to 11.1:

"11.1.1.9 Liability Insurance shall include all major divisions of coverage and be on a comprehensive basis including:

1. Premises Operations (including X, C, and U coverage's as applicable)
2. Independent Contractor's Protective
3. Products and Completed Operations
4. Personal Injury Liability with Employment Exclusion deleted
5. Contractual, including specified provision for Contractor's obligation under paragraph 3.18
6. Owned, non-owned and hired motor vehicles
7. Broad Form Property Damage including Completed Operations.

11.1.1,.10 Civil & Environmental Consultants, Inc shall be named as additional insured by all Contractors

11.1.1.11 If the General Liability coverage's are provided by a Commercial General Liability Policy on a claims made basis, the policy date or Retroactive Date shall predate the Contract; the

termination date of the policy or applicable extended reporting period shall be no earlier than the termination date of coverage's required to be maintained after final payment, certified in accordance with subparagraph 9.10.2"

Add the following to subparagraph 11.1.2:

"11.1.2.2 The insurance required by subparagraph 11.1.1 shall be written for not less than the following limits, or greater if allowed by law:

1. Worker's Compensation:
    a. State: Statutory
    b. Applicable Federal (eg Longshoremen's): Statutory
    c. Employer's Liability:
        i. $100,000 per Accident
        ii. $500,000 Disease, Policy Limit
        iii. $100,000 Disease, Each Employee
    d. Benefits Required by Union Labor Contracts: As Applicable
2. Comprehensive or Commercial General Liability (including Premises-Operations; Independent Contractor's Protective; Products and Completed Operations; Broad Form Property Damage):
    a. Bodily Injury:
        i. $3,000,000 Each Occurrence
        ii. $4,000,000 Aggregate
    b. Property Damage:
        i. $3,000,000 Each Occurrence
        ii. $3,000,000 Aggregate
    c. Products and Completed Operations to be maintained for a period of two years after final payment:
        i. $3,000,000 Aggregate
    d. Property Damage Liability Insurance shall provide X (explosion), C (collapse) and U (underground) coverage.

e. Broad Form Property Damage Coverage shall include Completed Operations

f. If the General Liability coverage's are provided by a Commercial Liability policy, the:

i. General Aggregate shall not be less than $3,000,000 and it shall apply, in total, to this Project only;

ii. Fire damage limit shall not be less than $500,00 on any one fire;

iii. Medical expense limit shall not be less than $50,000 on any one person

3. Contractual Liability:

a. Bodily Injury:

i. $1,000,000 Each Occurrence

ii. $2,000,000 Aggregate

b. Property Damage:

i. $1,000,000 Each Occurrence

ii. $2,000,000 Aggregate

4. Personal Injury, with Employment Exclusion deleted:

a. $1,000,000 Aggregate

5. Business Auto Liability (including owned, non-owned and hired vehicles):

a. $1,000,000 Each Occurrence

6. Umbrella Excess Liability:

a. $1,000,000 over primary insurance

b. $10,000 retention for self-insured hazards each occurrence.

Add the following subparagraph to 11.1.3:

"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, ACCORD form 25S will be acceptable."

Add the following to paragraph 11.1:

"11.1.5 All certificates of insurance shall contain the following endorsement within:

11.1.5.1 The Owner is interested in maintenance of this insurance and it is agreed that policies represented by this certificate will not be canceled or changed without thirty (30) days prior written notice to the Owner by return receipt mail.

11.1.5.2 It is agreed that policies represented by this certificate shall indemnify and hold harmless the Owner, the Architect, and their agents and employees as per paragraph 3.18.

11.1.6 Certificates of Insurance shall be issued by an insurance company holding an AM Best Rating of VII or better."

11.2 Owner's Liability Insurance

Add the following subparagraph:

"11.2.1.1 The Contractor shall purchase and maintain insurance covering the Owner's contingent liability for claims which may arise from operations under the Contract."

11.3 Property Insurance

11.3.1 In the first sentence, delete the words "Unless otherwise provided, the Owner" and substitute "the Contractor".

11.3.1 Add the following sentences: "The form of policy for this coverage shall be Completed Value. If the Owner is damaged by the failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable costs properly attributable thereto."

Delete Clause 11.3.1.2

Delete Clause 11.3.1.3

Delete subparagraph 11.3.4

Delete subparagraph 11.3.6 and substitute the following:

"11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner two certified copies of the policy or policies providing this Property Insurance coverage, each containing those endorsements specifically related to the Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner.

11.3.7 Delete this subparagraph

11.3.8 Delete the first sentence and change to: A loss insured under this property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the

insureds, as their interests may appear, subject to requirements of any applicable mortgage clause and of subparagraph 11.3.10

11.3.9 Delete the word “Owner”, and substitute “Contractor” each time the former word appears.

11.3.10 Delete the word “Owner”, and substitute “Contractor” each time the former word appears.

11.4 Performance Bond and Payment Bond

11.4.1 Delete subparagraph 11.4.1 and substitute the following:

“11.4.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Contractor’s usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to one hundred (100%) percent of the Contract Sum.

11.4.1.1 The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

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

ARTICLE 13 – MISCELLANEOUS PROVISIONS

Add Paragraph 13.8 Equal Opportunity as follows:

“13.8 Equal Opportunity

13.8.1 According to 62 Pa CSA 3701, the Contractor agrees that:

1. That in hiring of employees for the performance of the work under this contract, or any subcontract, no Contractor, Subcontractor, or any person acting on behalf of the Contractor or Subcontractor, shall, by reason of gender, race, creed, or color, discriminate against any citizen of this Commonwealth who is qualified and available to perform the work to which the employment relates.

2. No Contractor, Subcontractor, or any person on their behalf shall, in any manner, discriminate against or intimidate any employee hired for performance of work under his contract on account of gender, race, creed, or color.”

END OF DOCUMENT 000805

SECTION 010000 - GENERAL REQUIREMENTS

PART 1 - GENERAL (Not Used)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 010000

SECTION 010100 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Work covered by the Contract Documents.
2. Work phases.
3. Use of premises.
4. Specification formats and conventions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Irwin Borough Building “Building Renovations”

1. Project Location: 424 Main Street, Irwin, PA 15642
   a. (Existing township building is located on the second floor)

B. Owner: Borough of Irwin

1. Borough of Irwin, 424 Main Street, Irwin, PA 15642. #724-864-3100

C. Architect/Engineer: Civil & Environmental Consultants Inc.

D. The Work consists of the following:

1. The project is for interior renovations and minor exterior work at the existing Borough building. The existing administrative offices are located on the second floor and are not ADA accessible. The former first floor tenant has relocated and will allow the second-floor services to be relocated to the first floor. The project also includes ADA improvements and interior renovations to the police state also located in the subject property. The administrative area will have a new managers office, secure lobby area, conference room, break room and updated restrooms. Scope also includes modifications to the MEP systems to bring the areas of renovation up to current standards. No improvements are planned to the existing second floor as part of this contract. This will allow the police force and borough staff to continue to work and operate during the renovation project and allow for a smooth transition from their current space to the new.

2. Project will be constructed under a multi prime contract. Contracts will be for General Construction, Plumbing, HVAC, Electrical and Abatement. Some interior demolition and interior finish work will be performed by the Borough of Irwin or bid separately.

1.3 WORK SEQUENCE

1. All work shall be conducted in a single phase, as indicated on the Drawings and elsewhere in the Contract Documents. Milestone dates include.
   a. AWARD CONTRACTS: JUNE 11, 2025
   b. START CONSTRUCTION: JUNE 20, 2025
   c. FINAL COMPLETION: DECEMBER 12, 2025

The work shall be conducted in the phases shown above and shall be in compliance with the milestone dates listed. Any deviation from these phases or the work and milestone dates included in each phase shall be subject to approval of the Owner.

- Work in the building shall be performed in a sequence to ensure that all building systems are systematically installed in an efficient manner. The mechanical and electrical rooms shall be constructed in an early sequence to permit rough-in.

- All work must be completed in a sequence approved by the Owner and Architect.

- The General Construction Contractor shall be the coordinating contractor among the sub-contractors for the project. All other sub-contractors shall cooperate and coordinate their work with the General Construction Contractor.

- Work not properly coordinated with the General Construction Contractor and within the design intent shall be reinstalled by the respective sub-contractor including all associated work at no additional cost to the Owner.

- Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.4 USE OF PREMISES

A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1.5 OWNER'S OCCUPANCY REQUIREMENTS

A. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.

3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.6 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 48-division format and CSI/CSC's "MasterFormat" numbering system.

1. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 010100

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost allowances.
3. Contingency allowances.

C. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.
2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

1.2 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. 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.

C. 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.

1.6 LUMP-SUM AND UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.7 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit margins.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.8 TESTING AND INSPECTING ALLOWANCES

A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.

C. Costs of services not required by the Contract Documents are not included in the allowance.

D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

1.9 ADJUSTMENT OF 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.

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.

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Lump-Sum Allowance: Include the sum of $5,000 (Five thousand dollars and zero cents). This allowance is for the anticipated Building Permit costs as indicated in Section 011000 “Summary”.

1. This allowance includes material cost of the building permit only.
2. This allowance is not for inspections or other fees from the Building Department, these fees are the responsibility of the General Contractor.
3. This allowance does include any review fees or application or permit fees for HVAC/Plumbing/Electrical sub-contractor permits that may be required and which are the responsibility of the respective trades which should be included in the Contract Sum.
4. Any unused amount from this Allowance shall be credited back to the Owner at Project Closeout.

END OF SECTION 012100

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 01: Exterior windows.

1. Base Bid: The base bid will have all existing windows to remain, no work anticipated to the existing windows.
2. Alternate: Three new windows (W4) to be provided with new steel lintels. Windows and detailing to match existing windows along alley façade. If possible former window openings can be reused that is acceptable. Work is by the general contractor.

B. Alternate No. 02: Exterior Awning

1. Base Bid: The base bid will include only minor patching at the former Rosendahl's exterior signage removal and prep work as required for the exterior painting scope of work.
2. Alternate: A new exterior awning is proposed along (color to be selected from full range of manufacturers offerings). Work is by the general contractor.

C. Alternate No. 03: Fireman's roof mounted horn system.

1. Base Bid: The base bid will include modifications to the existing air tanks in the basement as required to accommodate the new basement work. Existing tanks and compressor to be reused.
2. Alternate: The existing system would be removed and a new fully electronic audible signal provided. Work is by the electrical contractor, provide cost and recommendations for a new system.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

b. Requested substitution provides sustainable design characteristics that specified product provided.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Requested substitution provides sustainable design characteristics that specified product provided.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

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

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
    e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use form acceptable to Architect.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

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

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
a. Architect will not review or certify initial Application for Payment until schedule of values has been submitted and approved by Architect.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Name of Architect.
c. Architect's project number.
d. Contractor's name and address.
e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

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

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

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

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

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

E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

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

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Submittal schedule (preliminary if not final).
5. List of Contractor's staff assignments.
6. List of Contractor's principal consultants.
7. Copies of building permits.
8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
9. Initial progress report.
10. Report of preconstruction conference.
11. Certificates of insurance and insurance policies.

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

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

I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706-1994, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A-1994, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707-1994, "Consent of Surety to Final Payment."

7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Coordination drawings.
2. Requests for Information (RFIs).
3. Project Web site.
4. Project meetings.

B. Related Requirements:
1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

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

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

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

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

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: AIA Document G716.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 10 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.
g. RFI’s that do not include a suggested solution from the contractor or sub-contractor that generated the RFI.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within five days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. Sustainable design requirements.
    l. Preparation of record documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Working hours.
    p. Owner's occupancy requirements.
    q. Responsibility for temporary facilities and controls.
    r. Procedures for moisture and mold control.
    s. Procedures for disruptions and shutdowns.
    t. Construction waste management and recycling.
    u. Parking availability.
    v. Office, work, and storage areas.
    w. Equipment deliveries and priorities.
    x. First aid.
    y. Security.
    z. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Sustainable design requirements.
    i. Review of mockups.
    j. Possible conflicts.
    k. Compatibility problems.
    l. Time schedules.
    m. Weather limitations.
    n. Manufacturer's written instructions.
    o. Warranty requirements.
    p. Compatibility of materials.
    q. Acceptability of substrates.
    r. Temporary facilities and controls.
    s. Space and access limitations.
    t. Regulations of authorities having jurisdiction.
    u. Testing and inspecting requirements.
    v. Installation procedures.
    w. Coordination with other work.
    x. Required performance results.
    y. Protection of adjacent work.
    z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

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

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.
        9) Progress cleaning.
        10) Quality and work standards.
        11) Status of correction of deficient items.
        12) Field observations.
        13) Status of RFIs.
        14) Status of proposal requests.
        15) Pending changes.
        16) Status of Change Orders.
        17) Pending claims and disputes.
        18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's construction schedule.
2. Construction schedule updating reports.
3. Daily construction reports.
4. Site condition reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.

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

F. Daily Construction Reports: Submit at monthly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

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

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

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
3. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

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

1. Phasing: Arrange list of activities on schedule by phase.
2. Work under More Than One Contract: Include a separate activity for each contract.
3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
4. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

5. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule three days before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

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

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit unaltered, original, full-size image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Name and contact information for photographer.
c. Date photograph was taken.
d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.
2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

D. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
1. Areas to be photographed include, but are not limited to:
    a. Mechanical chased prior to be closed up
    b. Underground utility installations prior to being backfilled

E. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

1. Architect may, at Architect’s discretion furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings for a stipulated, per Drawing/Sheet fee.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

b. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
c. No Electronic Data will be transferred until fees outlined in the Agreement are paid by the Contractor.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals. Submittals received after 1:00 pm shall be considered as received the following day.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of subcontractor.
g. Name of supplier.
h. Name of manufacturer.
i. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals

shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.

a. Transmittal Form for Paper Submittals: Use AIA Document G810 (or other format approved for use by Architect prior to initial submittal).
b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

1) Project name.
2) Date.
3) Destination (To:).
4) Source (From:).
5) Name and address of Architect.
6) Name of Construction Manager.
7) Name of Contractor.
8) Name of firm or entity that prepared submittal.
9) Names of subcontractor, manufacturer, and supplier.
10) Category and type of submittal.
11) Submittal purpose and description.
12) Specification Section number and title.
13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Architect**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.

F. Options: Identify options requiring selection by Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

K. Email Requirements: Clearly label all subject lines with Project Name and submittal number and naming for ease of tracking and searching of electronic submittal submissions.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.

    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: If submitting paper copies, submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
3. Informational Submittals: If submitting paper copies submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

    a. PDF electronic file.
    b. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

4. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
5. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.

6. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
7. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

8. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

9. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of

color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:

a. PDF electronic file.

E. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures.

H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

T. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.

2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.

d. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections and in Statement of Special Inspections listed in the Contract Drawings, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

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

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
8. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
9. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
10. AF&PA - American Forest & Paper Association; www.afandpa.org.
11. AGA - American Gas Association; www.aga.org.
12. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
13. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
14. AI - Asphalt Institute; www.asphaltinstitute.org.
15. AIA - American Institute of Architects (The); www.aia.org.
16. AISC - American Institute of Steel Construction; www.aisc.org.
17. AISI - American Iron and Steel Institute; www.steel.org.
18. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
19. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
20. ANSI - American National Standards Institute; www.ansi.org.
21. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
22. APA - APA - The Engineered Wood Association; www.apawood.org.
23. APA - Architectural Precast Association; www.archprecast.org.
24. API - American Petroleum Institute; www.api.org.
25. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
26. ARI - American Refrigeration Institute; (See AHRI).
27. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
28. ASCE - American Society of Civil Engineers; www.asce.org.
29. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
30. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
31. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
32. ASSE - American Society of Safety Engineers (The); www.asse.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.

34. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
35. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
36. AWEA - American Wind Energy Association; www.awea.org.
37. AWI - Architectural Woodwork Institute; www.awinet.org.
38. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
39. AWPA - American Wood Protection Association; (Formerly: American Wood-Preservers' Association); www.awpa.com.
40. AWS - American Welding Society; www.aws.org.
41. AWWA - American Water Works Association; www.awwa.org.
42. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
43. BIA - Brick Industry Association (The); www.gobrick.com.
44. BICSI - BICSI, Inc.; www.bicsi.org.
45. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.com.
46. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
47. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bwfbadminton.org.
48. CDA - Copper Development Association; www.copper.org.
49. CEA - Canadian Electricity Association; www.electricity.ca.
50. CEA - Consumer Electronics Association; www.ce.org.
51. CFFA - Chemical Fabrics & Film Association, Inc.; www.chemicalfabricsandfilm.com.
52. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
53. CGA - Compressed Gas Association; www.cganet.com.
54. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
55. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
56. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
57. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
58. CPA - Composite Panel Association; www.pbmdf.com.
59. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
60. CRRC - Cool Roof Rating Council; www.coolroofs.org.
61. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
62. CSA - Canadian Standards Association; www.csa.ca.
63. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
64. CSI - Construction Specifications Institute (The); www.csinet.org.
65. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
66. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
67. CWC - Composite Wood Council; (See CPA).
68. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
69. DHI - Door and Hardware Institute; www.dhi.org.
70. ECA - Electronic Components Association; (See ECIA).
71. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
72. ECIA ? Electronic Components Industry Association; www.eciaonline.org.
73. EIA - Electronic Industries Alliance; (See TIA).
74. EIMA - EIFS Industry Members Association; www.eima.com.
75. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
76. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
77. ESTA - Entertainment Services and Technology Association; (See PLASA).
78. EVO - Efficiency Valuation Organization; www.evo-world.org.

79. FIBA - F?d?ration Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
80. FIVB - F?d?ration Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
81. FM Approvals - FM Approvals LLC; www.fmglobal.com.
82. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
83. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
84. FSA - Fluid Sealing Association; www.fluidsealing.com.
85. FSC - Forest Stewardship Council U.S.; www.fscus.org.
86. GA - Gypsum Association; www.gypsum.org.
87. GANA - Glass Association of North America; www.glasswebsite.com.
88. GS - Green Seal; www.greenseal.org.
89. HI - Hydraulic Institute; www.pumps.org.
90. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
91. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
92. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
93. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
94. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
95. IAS - International Accreditation Service; www.iasonline.org.
96. IAS - International Approval Services; (See CSA).
97. ICBO - International Conference of Building Officials; (See ICC).
98. ICC - International Code Council; www.iccsafe.org.
99. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
100. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
101. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
102. IEC - International Electrotechnical Commission; www.iec.ch.
103. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
104. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
105. IESNA - Illuminating Engineering Society of North America; (See IES).
106. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
107. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
108. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
109. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
110. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
111. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
112. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
113. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
114. ISO - International Organization for Standardization; www.iso.org.
115. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
116. ITU - International Telecommunication Union; www.itu.int/home.
117. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
118. LMA - Laminating Materials Association; (See CPA).
119. LPI - Lightning Protection Institute; www.lightning.org.
120. MBMA - Metal Building Manufacturers Association; www.mbma.com.
121. MCA - Metal Construction Association; www.metalconstruction.org.

122. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
123. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
124. MHIA - Material Handling Industry of America; www.mhia.org.
125. MIA - Marble Institute of America; www.marble-institute.com.
126. MMPA - Moulding & Millwork Producers Association; (Formerly: Wood Moulding & Millwork Producers Association); www.wmmpa.com.
127. MPI - Master Painters Institute; www.paintinfo.com.
128. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
129. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
130. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
131. NADCA - National Air Duct Cleaners Association; www.nadca.com.
132. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
133. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
134. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
135. NCMA - National Concrete Masonry Association; www.ncma.org.
136. NEBB - National Environmental Balancing Bureau; www.nebb.org.
137. NECA - National Electrical Contractors Association; www.necanet.org.
138. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
139. NEMA - National Electrical Manufacturers Association; www.nema.org.
140. NETA - InterNational Electrical Testing Association; www.netaworld.org.
141. NFHS - National Federation of State High School Associations; www.nfhs.org.
142. NFPA - NFPA; (National Fire Protection Association); www.nfpa.org.
143. NFPA - NFPA International; (See NFPA).
144. NFRC - National Fenestration Rating Council; www.nfrc.org.
145. NHLA - National Hardwood Lumber Association; www.nhla.com.
146. NLGA - National Lumber Grades Authority; www.nlga.org.
147. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
148. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
149. NRCA - National Roofing Contractors Association; www.nrca.net.
150. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
151. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
152. NSPE - National Society of Professional Engineers; www.nspe.org.
153. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
154. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
155. NWFA - National Wood Flooring Association; www.nwfa.org.
156. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
157. PDI - Plumbing & Drainage Institute; www.pdionline.org.
158. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
159. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
160. RFCI - Resilient Floor Covering Institute; www.rfci.com.
161. RIS - Redwood Inspection Service; www.redwoodinspection.com.
162. SAE - SAE International; (Society of Automotive Engineers); www.sae.org.
163. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
164. SDI - Steel Deck Institute; www.sdi.org.
165. SDI - Steel Door Institute; www.steeldoor.org.
166. SEFA - Scientific Equipment and Furniture Association; www.sefalabs.com.

167. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
168. SIA - Security Industry Association; www.siaonline.org.
169. SJI - Steel Joist Institute; www.steeljoist.org.
170. SMA - Screen Manufacturers Association; www.smainfo.org.
171. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
172. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
173. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
174. SPIB - Southern Pine Inspection Bureau; www.spib.org.
175. SPRI - Single Ply Roofing Industry; www.spri.org.
176. SRCC - Solar Rating and Certification Corporation; www.solar-rating.org.
177. SSINA - Specialty Steel Industry of North America; www.ssina.com.
178. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
179. STI - Steel Tank Institute; www.steeltank.com.
180. SWI - Steel Window Institute; www.steelwindows.com.
181. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
182. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
183. TCNA - Tile Council of North America, Inc.; (Formerly: Tile Council of America); www.tileusa.com.
184. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
185. TIA - Telecommunications Industry Association; (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
186. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
187. TMS - The Masonry Society; www.masonrysociety.org.
188. TPI - Truss Plate Institute; www.tpinst.org.
189. TPI - Turfgrass Producers International; www.turfgrasssod.org.
190. TRI - Tile Roofing Institute; (Formerly: National Tile Roofing Manufacturing Association); www.tileroofing.org.
191. UBC - Uniform Building Code; (See ICC).
192. UL - Underwriters Laboratories Inc.; www.ul.com.
193. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
194. USAV - USA Volleyball; www.usavolleyball.org.
195. USGBC - U.S. Green Building Council; www.usgbc.org.
196. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
197. WASTEC - Waste Equipment Technology Association; www.wastec.org.
198. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
199. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
200. WDMA - Window & Door Manufacturers Association; www.wdma.com.
201. WI - Woodwork Institute; (Formerly: WIC - Woodwork Institute of California); www.wicnet.org.
202. WMMPA - Wood Moulding & Millwork Producers Association; (See MMPA).
203. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
204. WPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
   1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.

2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; http://dodssp.daps.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; http://eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeia; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from Department of Defense Single Stock Point; http://dodssp.daps.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

6. MILSPEC - Military Specification and Standards; (See DOD).

7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic Appliance and Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas Forest Service; Forest Resource Development and Sustainable Forestry; http://txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. 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.

C. 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.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

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.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 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. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide concrete bases for supporting posts.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

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: Unless Owner authorizes use of permanent HVAC system, 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 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: If Owner authorizes 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 017700 "Closeout Procedures".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

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.

3.2 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. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash 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.

E. 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.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead unless otherwise indicated.
2. Connect temporary service to Owner's existing power source, as directed by Owner.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

K. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Processor: Intel Pentium D or Intel CoreDuo, 3.0 GHz processing speed.
2. Memory: 4 gigabyte.
3. Disk Storage: 300 gigabyte hard-disk drive and combination DVD-RW/CD-RW drive.
4. Display: 22-inch LCD monitor with 128 Mb dedicated video RAM.
5. Network Connectivity: 10/100BaseT Ethernet.

6. Productivity Software:

    a. Microsoft Office Professional, XP or higher, including Word, Excel, and Outlook.
    b. Adobe Reader 7.0 or higher.
    c. WinZip 7.0 or higher.

7. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
8. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.
9. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."

C. 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.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs.
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.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: 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.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.

D. 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.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, 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 environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

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 not complete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.

2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Discard or replace water-damaged and wet material.
4. Discard, replace, or clean stored or installed material that begins to grow mold.
5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 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 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product

request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, Contractor shall treat that manufacturer or product listing as a “Basis of Design” only. Contractor is permitted to furnish the named manufacturer or product or to follow requirements listed in “Basis-of-Design Product” paragraph below.

2. Products:
   a. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

3. Manufacturers:
   a. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

4. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

B. Certified Surveys: Submit two copies signed by land surveyor.

C. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding.

Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even

surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
3. Section 044313 "Adhered Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
4. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris.

1. Provide appropriately marked containers or bins for controlling co-mingled recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
1. Clean and stack undamaged, whole masonry units on wood pallets.

B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

C. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

D. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

E. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

F. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

G. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

H. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

I. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

J. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

K. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.

10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

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

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.

2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Architect will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

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

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following formats (Note, operations and maintenance manuals are required to be submitted in BOTH formats):

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily

navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.

7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

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

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Requirements:

1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit two set(s) of marked-up record prints and one annotated PDF electronic file.

B. Record Specifications: Submit one paper copy and one annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and one copy each of annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it.

c. Record and check the markup before enclosing concealed installations.

2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Manuals: Submit two copies within seven days of end of each training module.

1. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.

d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

END OF SECTION 017900

SECTION 033000 CAST-

IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete.
2. Concrete Forming and Accessories.
3. Concrete Reinforcing.
4. Concrete Finishing.
5. Concrete Curing.
6. Control, Expansion, and Contraction Joint Devices.

1.2 REFERENCES

A. Abbreviations and Acronyms:
1. American Concrete Institute (ACI).
2. Engineered Wood Association, formerly American Plywood Association (APA).
3. American Society of Mechanical Engineers (ASME).
4. American Society of Testing and Materials (ASTM).
5. American Welding Society (AWS).
6. Concrete Reinforcing Steel Institute (CRSI).
7. Federal Specifications and Standards (FS).
8. High Density Overlay (HDO).
9. International Code Council (ICC).
10. International Building Code (IBC).
11. National Ready Mixed Concrete Association (NRMCA).
12. Polyvinyl chloride (PVC).

B. References Standards:
1. ACI 117, Specification for Tolerances for Concrete Construction and Materials.
2. ACI 211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
3. ACI 301, Specifications for Structural Concrete.
4. ACI 305.1, Specification for Hot Weather Concreting.
5. ACI 306.1, Standard Specification for Cold Weather Concreting.
6. ACI 308.1, Standard Specification for Curing Concrete.
7. ACI 318, Building Code Requirements for Structural Concrete.
8. ACI SP-66, ACI Detailing Manual.
9. American Society of Mechanical Engineers (ASME) A17.1.
10. American Society of Testing and Materials (ASTM) A706, Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
11. ASTM A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.

12. ASTM A934, Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
13. ASTM B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
14. ASTM C31/C31M, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
15. ASTM C33, Standard Specification for Concrete Aggregates.
16. ASTM C39/C39M, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
17. ASTM C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
18. ASTM C94/C94M, Standard Specification for Ready-mixed Concrete.
19. ASTM C150, Standard Specification for Portland Cement.
20. ASTM C172, Standard Practice for Sampling Freshly Mixed Concrete.
21. ASTM C173/C173M, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
22. ASTM C260, Standard Specification for Air-entraining Admixtures for Concrete.
23. ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
24. ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
25. ASTM C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
26. ASTM C685/C685M, Standard Specification for Concrete Made By Volumetric Batching and Continuous Mixing.
27. ASTM C989, Standard Specification for Slag Cement for Use in Concrete and Mortars.
28. ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
29. ASTM C1218/C1218M, Standard Test Method for Water-soluble Chloride in Mortar and Concrete.
30. ASTM C1240, Standard Specification for Silica Fume Used in Cementitious Mixtures.
31. ASTM A1602,
32. ASTM D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
33. ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
34. ASTM D6690, Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
35. ASTM E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
36. ASTM E1643, Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.
37. ASTM E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

38. Concrete Reinforcing Steel Institute (CRSI) MSP-1, Manual of Standard Practice.

1.3 DESIGN REQUIREMENTS

A. Formwork and Accessories:
1. Design, engineer, and construct formwork, shoring, and bracing in accordance with the most stringent requirements of ACI 117, ACI 318, and ACI 301 to achieve concrete shape, line, and dimension as indicated on Drawings.
2. Form and shoring design to be the responsibility of the Contractor.
3. Design forms and shoring to support, properly and safely, vertical and lateral loads for applicable construction, material, pre-stressing, environmental, impact, and other anticipated loads until the structure can carry such loads.

1.4 SUBMITTALS

A. Refer to the Submittal Schedule at the end of Part 3 for a list of submittal requirements for this Section.

1.5 QUALITY ASSURANCE

A. Formwork and Accessories:
1. Perform Work in accordance with ACI 301, ACI 117, and ACI 318.
2. Plywood form panels to be marked with an APA grade mark.

B. Reinforcing:
1. Perform Work in accordance with ACI 318.
2. Prepare shop drawings in accordance with ACI SP-66.
3. Testing/inspection agencies to be in conformance with ASTM E329 and to qualify as an approved agency per ICC International Building Code requirements.

C. Concrete:
1. Perform Work in accordance with ACI 318.
2. Testing/inspection agencies to be in conformance with ASTM E329, and all tests to be performed in accordance with ACI 301 and ICC International Building Code requirements.
3. Submit proposed mix design for each class of concrete to the Engineer for review prior to commencement of work.
4. Acquire cement and aggregate from one source for Work.

D. Finishing and Curing: Perform Work in accordance with ACI 301, ACI 308.1, and ACI 318.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Concrete:
1. Conform to ACI 305.1 when concreting during hot weather.
2. Conform to ACI 306.1 when concreting during cold weather.

a. Maintain concrete temperature after installation at minimum 50 degrees F for minimum 7 days.

b. For high early strength concrete, maintain concrete temperature after installation at minimum 50 degrees F for minimum 3 days.

1.7 COORDINATION

A. Reinforcing: Coordinate with placement of formwork, formed openings, and other Work. Reinforcing steel not to be located or placed in the forms until form release and bond breaker coating work is completed.

B. Concrete: Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

C. Finishing: Coordinate the Work with concrete floor placement and concrete floor curing.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Void Forms:
1. Deliver void forms and installation instructions in manufacturer's packaging.
2. Store off ground in ventilated and protected manner to prevent contamination, soiling, and/or damage.

B. Reinforcing:
1. Reinforcing to be delivered to the site in bundles marked with tags calling out bar size, length, grade, piece number, and bend diagram.
2. Mark reinforcing and accessories for proper identification and placement location.
3. Store materials off ground and protect from moisture and contamination.

C. Concrete:
1. Transport of ready-mix concrete to be in accordance with ASTM C94.
2. Ready-mix trucks to be in accordance with ASTM C94, NCRMA, and the Department of Transportation in the state where the project is located.
3. Admixtures to be added to the mix at the batch plant.
4. Disposal of excess concrete onsite is not permitted.
5. Mark reinforcing, accessories, and embedded items for proper identification and placement location.
6. Deliver packaged items in manufacturer's container with seals intact.
7. Store materials, except aggregate, off ground and protect from moisture and contamination.
8. Stockpile aggregate in manner to prevent contamination with other materials or with other sizes of aggregates. Conduct tests for determining conformance to requirements at point of batching. Do not use bottom 6 inches of aggregate piles in contact with ground. Allow sand to drain until it has reached uniform moisture content before it is used.
9. Store admixtures in manner to prevent contamination. Protect admixtures from extreme temperatures which would adversely affect their characteristics.

D. Curing:
1. Deliver curing materials in manufacturer's packaging including application instructions.
2. Store curing materials off ground and protect from moisture and contamination; protect materials from extreme temperature which would adversely affect their characteristics.

PART 2 PRODUCTS

2.1 FORMWORK

A. Plywood for Concrete Surfaces Not to be Exposed After Construction is Complete:
1. APA B-B Plyform exterior grade or better, Class I, with straight, sealed edges and 5/8-inch minimum thickness.
2. HDO Plyform is acceptable.

B. Plywood for Concrete Surfaces to be Exposed After Construction is Complete: APA HDO Plyform, exterior grade or better, Class I, with straight, sealed edges and 5/8-inch minimum thickness.

C. Lumber: Dressed, tongue and grooved, free from loose knots.

D. Metal: Smooth, clean, corrosion-free, without dents or holes, with closely-matching edges.

E. Fiberglass: Smooth, clean, without dents or holes, with closely-matching edges.

F. Laminated Round Fiber Tubes: Spirally laminated paper fiber, wax impregnated on exterior surfaces, interior ply allowing uniform moisture penetration.

G. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; minimum 2 inches thick.
1. Manufacturers:
a. Deslauriers, Inc., Model https://www.deslinc.com/box-voids or Engineer-approved equivalent.

2.2 FORM RELEASE AGENTS

A. Type acceptable to cement manufacturer, will not cause surface imperfections, non-staining, and compatible with field applied paints, toppings, linings, curing compounds, and other coatings.

B. For concrete surfaces in water storage or treatment structures use agent that will be nontoxic within 30 days after use.

C. Use same brand form release agent for all forms.

2.3 FORMWORK ACCESSORIES

A. Form ties, anchors, and hangers to be of sufficient strength to completely resist displacement of forms due to construction loads and depositing of concrete.

B. Provide ties and spreader form ties designed so no metal will be within 1 inch of surface when forms are removed.

C. Where concrete surfaces are exposed to view, use form ties that will leave a depression not more than 1 inch in diameter when removed.

D. Use water seal ties in concrete work containing waterstops.

E. Provide form sealants and gaskets as necessary to provide tight forms.

F. Corners: Chamfer, type; 3/4-inch x 3/4-inch size; maximum possible lengths.

G. Dovetail Anchor Slot: Galvanized steel, 22 gauge thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

H. Flashing Reglets: Galvanized steel, 22 gauge thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

I. Bituminous Joint Filler: ASTM D1751.

J. Anchor Bolt Sleeves:
1. Manufacturers:
a. Wilson Anchor Bolt Sleeve Company, Model Wilson Sleeves, or Engineer-approved equivalent.

K. Wall and Slab Sleeves: ASTM D1785, Schedule 40 PVC pipe.

2.4 WATERSTOPS

A. Flexible PVC Waterstops: continuous 3/8-inch x 6-inch polyvinyl chloride, serrated without center bulb. Acceptable products as shown on Drawings.

B. Cold Joint Waterstops: Volclay waterstop as manufactured by American Colloid Company or Engineer-approved equivalent.

2.5 REINFORCEMENT

A. Deformed Reinforcement: ASTM A615; 60 ksi yield strength, steel bars, unfinished, unless otherwise noted.

B. Weldable Reinforcement: ASTM A706; 60 ksi yield strength, steel bars, unfinished.

C. Welded Plain Wire Fabric: ASTM A185; unfinished.

2.6 REINFORCEMENT ACCESSORIES

A. Chairs, Bolsters, Bar Supports, and Spacers: Sized and shaped for strength and support of reinforcement during concrete placement conditions including load bearing pad on bottom to prevent vapor retarder puncture.

B. Special Chairs, Bolsters, Bar Supports, Spacers Adjacent to Weather Exposed Concrete Surfaces: Class 1A or Class 3 type; size, and shape to meet Project conditions. Provide supports appropriate for concrete exposure and surface grinding/sandblasting requirements.

C. Welding Reinforcing Splicing Devices: Exothermic welding type; full tension; sized to fit joined reinforcing and designed to develop 125 percent of the yield strength of the reinforcing steel.
   1. Manufacturers:
      a. Erico Products, Inc., Model “Cadweld”, or approved equivalent.

D. Mechanical Reinforcing Splicing Devices: Mechanical threaded type; full tension; sized to fit joined reinforcing and designed to develop 125 percent of the yield strength of the reinforcing steel.
   1. Manufacturers:
      a. Erico Products, Inc., Model “Lenton”.
      b. Erico Products, Inc., Model “Lenton Lock”.

E. Epoxy Coating Patching Material: Conform to ASTM A775.

2.7 REINFORCEMENT FABRICATION

A. Fabricate concrete reinforcement in accordance with CRSI and ACI SP-66, except ensure splice lengths are in accordance with ACI 318.

B. Tie reinforcing bars in bundles and tag with non-rusting tags showing shop drawing numbers.

C. Form standard hooks as indicated on Drawings with minimum bend diameters in accordance with ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Spiral column reinforcement:
   1. Form from minimum 3/8-inch-diameter continuous deformed bar or wire.
   2. Spirals to have 1-1/2 extra finishing turns at top and bottom.

F. Weld reinforcement in accordance with AWS D1.4.

G. Epoxy-Coated Reinforcement: Clean surfaces, weld and re-protect welded joint in accordance with CRSI MSP-1.

2.8 REINFORCEMENT SHOP FINISHING

A. Epoxy Coated Finish for Steel Bars: ASTM A775or, for prefabricated steel bars, ASTM A934.

B. Epoxy Coated Finish for Steel Wire: ASTM A884; Class A using ASTM A775.

2.9 CONCRETE MATERIALS

A. Cement: ASTM C150, Type II – Moderate Portland type.

B. Aggregates:
1. Normal Weight Aggregates: ASTM C33.
2. Lightweight Aggregate: ASTM C330
3. For slabs and watertight concrete conform to following:
a. Of total combined coarse and fine aggregates per mix design, do not allow material retained on any one sieve to be less than 8 percent nor more than 24 percent of total by weight, except for largest sieve and Nos. 30, 50, and 100 sieves.
b. Gradation requirement of ASTM C33 may be waived in order to meet ranges specified.
c. Retain 1 percent to 4 percent of total combined aggregates per mix design on 3/4-inch sieve.
d. Maintain 8 percent to 15 percent of total combined aggregates per mix design is retained on each of Nos. 30 and 50 sieves.

C. Fly Ash: ASTM C618 Class C or F, except loss on ignition is not to exceed 3 percent.

D. Silica Fume: ASTM C1240.

E. Slag: ASTM C989; minimum Grade 100; ground granulated blast furnace slag.

F. Water: ASTM C1602.

2.10 ADMIXTURES

A. General:
1. No admixture to contain more than 0.05 percent chloride ions. In no case shall the resulting chloride content exceed ACI 318 provisions.
2. If slab toppings are bonded to concrete, manufacturer of topping to approve the type and brand of admixture used.
3. Submit information needed for manufacturer to determine if there is problem with compatibility.

B. Types:
1. Air-Entraining: ASTM C260.
2. Water-Reducing: ASTM C494, Type A.
3. High-Range Water-Reducing: ASTM C494, Type F or G.
a. Type F Acceptable Products and Manufacturers:

1) "Eucon 37, Eucon 1037, or Plastol 5000" by Euclid Chemical Corp.
2) "Daracem 100" or "ADVA 190" by W. R. Grace & Co.

b. Type G Acceptable Products and Manufacturers:
1) "Eucon 537" by Euclid Chemical Corp.
2) "Daracem 100" by W. R. Grace & Co.

4. Retarding: ASTM C494, Type B or D.
5. Accelerating:
a. ASTM C494, Type C or E. Non-chloride and non-thiocyanate type.
b. Acceptable Products and Manufacturers:
1) "Accelguard 80" by Euclid Chemical Corp.
2) "Polar Set: by W.R. Grace & Co.

2.11 ACCESSORIES

A. Vapor Retarder/Barrier: As shown on Drawings.

2.12 JOINT DEVICES AND FILLER MATERIALS

A. Expansion Joint Cap:
1. Two-part plastic cap for use over preformed joint filler.
2. Acceptable Product and Manufacturer:
a. "Snap-Cap" by W. R. Meadows, Inc.

B. Preformed Joint Filler:
1. ASTM D5249, Type 2, nonextruding, 3/8-inch wide by full depth of concrete with top of cap strip at finished surface.
2. Acceptable Product and Manufacturer: As shown on Drawings.

C. Firm Preformed Joint Filler: ASTM D1751, nonextruding, full depth of concrete.

D. Elastomeric Joint Materials:
1. Sealant:
a. FS TT-S-00230, Type I, Class A, single component cold applied, pourable or gun grade, as applicable, polyurethane base.
b. Closely match color of adjacent exposed surface of concrete slab and closely match color of epoxy joint sealant.
c. Keep same color throughout project.
d. Sealant to be compatible with construction material placed against it.
e. Acceptable Product and Manufacturer: As shown on Drawings.
2. Joint Back-Up Material:
a. Polyethylene foam, 60 percent closed cell.
b. Sealant to be compatible with any construction material to be placed against it, such as tile adhesive.

E. Epoxy Joint Filler:
1. 100 percent solids per ASTM D1259, two-part semi-rigid epoxy with instantaneous Shore A hardness minimum of 80 per ASTM D2240, adhesion to concrete of 150 to 250 psi per ASTM C321, minimum elongation of 6 percent

per ASTM D638, and a tensile strength of 350 to 600 psi per ASTM D638 at 7 days. Filler to be compatible with construction material placed against it, such as tile adhesive.

2. Closely match color of adjacent exposed surface of concrete slab. Keep same color throughout project.
3. Acceptable Products and Manufacturers:
   a. "Euco 700" by Euclid Chemical Corp.
   b. "MM-80P" by Metzger-McGuire Co.

F. Slab on Grade Dowels for Construction Joints: Smooth round bar, ASTM A36; sawcut, not sheared.

2.13 CONCRETE MIX

A. General:
1. Use only materials and their proportions included on concrete supplier's standard mix design forms for this Project that Engineer has given final review.
2. Measure and mix ingredients in accordance with most stringent requirements of ACI 211.1, ACI 301, and ASTM C94.

B. Workability: Must have proper consistency to be worked readily into forms and around reinforcement without segregation, voids or, excessive bleeding.

C. Provide concrete to the following criteria:

Type of Construction	**Minimum 28-day Compressive Strength**	**Total Air**	**Minimum Cement Factor (Bags/cu. yd)**	**Maximum W/C Ratio**
Footings, Pile Caps	4,000 psi	Optional (8% max)	5.0	--
Slabs on Ground	4,000 psi	No Air Entraining	5.5	0.56
Elevated Floor Slabs	4,000 psi	No Air Entraining	6.0	0.60 0.56
Concrete Columns	4,000 psi	No Air Entraining	6.0	0.60
Concrete Exposed to Weather	4,500 psi	4-8%	6.0	0.51
Liquid Retaining Structures	4,500 psi	4-8%	6.0	0.45
Other Concrete	4,000 psi	Optional (8% max)	5.5	0.60

D. Slump:
1. Proportion concrete so slump without adding mid-range or high-range water-reducing admixture or fibers, if used, would be as follows:

Types of Construction	Slump (in.)
Mass concrete (unreinforced concrete 3 feet or more in the least dimension)	2 (±1)
Floor Slabs and Pavement	4 (±1)
All Other Concrete	4 (±1)

2. If high-range water-reducing admixture is used, maximum slump after adding admixture to be 8 inches.

E. Admixtures:
1. Water-reducing admixture may be added to improve workability and reduce water content.
2. Mid-range or high-range water-reducing admixture may be added to improve workability or pumpability, lower water/cement ratio, increase ultimate and early strengths, and increase slump.
3. Provide an air-entraining admixture where air-entrainment is specified. Do not air-entrain interior floor slabs with troweled finish.
4. Other admixtures may be used only with written approval.
5. Do not use calcium chloride, or admixtures containing more than 0.05 percent chloride ions. In no case shall the resulting chloride content exceed ACI 318 provisions.
6. Use admixtures in accordance with manufacturer's recommendations.

F. Supplementary Cementitious Materials:
1. Fly ash may be used as partial replacement for Portland cement if approved by the Engineer and if other requirements of this Section are met. However, do not use fly ash in floor slabs. Use maximum percent of fly ash below for all mass equipment foundations.
2. If fly ash is used, ensure weight of fly ash divided by sum of cement and fly ash weights is at least 15 percent and does not exceed following:
   a. Class C Fly Ash: 25 percent.
   b. Class F Fly Ash: 20 percent.
3. Take special care concerning following:
   a. Maintain air-entrainment at specified levels.
   b. In cold weather ensure that concrete strength gain is above specified levels.

G. Average Compressive Strength Reduction: Permitted in accordance with ACI 318.

H. Site Mixed Concrete: Mix concrete in accordance with ACI 301 and 318. Use a central-mix type batch plant.

2.14 HARD AGGREGATE FLOOR SURFACE MATERIAL

A. Provide factory mixed combination of Portland cement, plasticizers, and hard aggregate graded to produce maximum density.

B. Acceptable Products and Manufacturers for Mineral Aggregate:
1. "Surflex" (coarser gradation) by Euclid Chemical Co.
2. "MasterTop 110 ABR" by Master Builders Solutions.

2.15 CURING MATERIALS

A. Sheet Materials for Curing Concrete: ASTM C171.
1. Synthetic Fiber/Plastic:
a. White synthetic fiber matting securely attached to white plastic sheet backing.
b. Acceptable Products and Manufacturer:
1) "Transguard 4000" by Fiber-Tec.
2) "HydraCure" by PNA Construction Technologies.
2. Coated Burlap:
a. ASTM C171, 10-ounce burlap with 4-mil minimum white opaque polyethylene extruded onto burlap.
b. Acceptable Product and Manufacturer: "Cure Lap" by Midco.

B. Liquid Membrane Curing and Sealing Compound:
1. Conform to ASTM C1315, Type I (VOC compliant, 700 g/l).
2. Styrene-acrylate or methyl-methacrylate type, 25 percent minimum solids content, clear, non- yellowing, with no styrene-butadiene.
3. Acceptable Product and Manufacturer: "Super Rez-Seal" by Euclid Chemical Corp.

C. Liquid Membrane Curing and Sealing Compound:
1. Conform to ASTM C1315, Type I (VOC compliant, 350 g/l).
2. Styrene-acrylate or methyl-methacrylate type, 25 percent minimum solids content, clear, non- yellowing, with no styrene-butadiene.
3. Acceptable Product and Manufacturer: "Super Aqua-Clear VOX or Super Diamond Clear VOX" by Euclid Chemical Corp.

D. Curing Compound (Strippable):
1. Conform to ASTM C309.
2. For use on slabs receiving subsequent applied finish.
3. Acceptable Products and Manufacturer:
a. "Kurez DR VOX or Kurez W VOX" by Euclid Chemical Co.

E. Liquid Sealer/Densifier:
1. High performance, deeply penetrating concrete densifier; odorless, colorless, VOC-compliant, non-yellowing siliconate based solution designed to harden, dustproof and protect concrete floors subjected to heavy vehicular traffic and to resist black rubber tire marks on concrete surfaces.
2. The compound must contain a minimum solids content of 20 percent of which 50 percent is siliconate.
3. Acceptable Products and Manufacturers:
a. "Diamond Hard" by The Euclid Chemical Company.
b. "Sealhard" by L & M Chemical Corp.

F. Water: ASTM C1602.

PART 3 EXECUTION

3.1 EXAMINATION

A. Formwork and Accessories:
1. Verify lines, levels, and centers before proceeding with formwork. Verify dimensions agree with Drawings.
2. Verify that subgrade surfaces and excavations are ready to receive formwork.

B. Concrete:
1. Verify requirements per ACI 301 for concrete cover over reinforcement are met.
2. Verify anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

3.2 PREPARATION

A. Formwork and Accessories:
1. Form surfaces to be free of dirt, mud, mortar, loose or nonadherent rust, and other foreign material.
2. Form and form liner surfaces to be against concrete to be treated with a form release agent prior to positioning of the forms and placement of the reinforcing steel and concrete.
3. Form surfaces to be against concrete at concrete surfaces exposed to view to be free of surface irregularities and patches and be capable of producing the desired finish.
4. Earth cuts may be used as forms for vertical surfaces of footings which are not to be exposed to view only where the soil is firm and stable and to be subject to prior review by project Geotechnical Engineer.
5. Earth form surfaces to be cut neat and accurate in size and shape and to be compact. Top edges of earth forms to be cleaned of loose material to prevent sloughing.
6. Concrete section dimensions to be increased as required to provide reinforcing steel with minimum specified cover at earth forms.

B. Reinforcement:
1. At the time of concrete placement, reinforcing steel to be free from dirt, mud, grease, oil, ice or snow, kinks, loose or non-adherent rust, loose mill scale, form-release coating/sealer or bond breaker, and any foreign matter or nonmetallic coating that adversely affects the bonding capacity of the reinforcing steel with the concrete.
2. Bars extending though construction joints to be cleaned of concrete and other contaminants prior to placement of subsequent concrete.
3. Surface preparation for welding to be in accordance with AWS D1.4, except loose or non-adherent rust and loose mill scale, which are to be removed by wire brushing.

4. Turn tie wire ends away from concrete exterior.

C. Concrete:
1. Prior to placement of concrete, the formwork is to have been completed, all reinforcing steel and embedded items positioned and secured in place, the space in which the concrete is to be placed free of all debris and rubbish, spilled concrete, sloughed soil, standing water, etc., and the entire preparation inspected and accepted.
2. Steel floor deck surfaces to be against concrete to be free from dirt, mud, dust, grease, oil, wax, ice or snow, frost laitance, and/or unsound material, and any foreign matter or coating that adversely affects the bonding capacity of the concrete.
3. Prior to placing of subsequent concrete at construction joints, the contact surface to be cleaned by sandblasting or as specified by bonding agent manufacturer to remove all laitance, expose the aggregate, and roughen the surface to a minimum of 1/4-inch amplitude. Clean contact surfaces to remove loose and/or foreign material. Construction joints to be inspected prior to closing of forms and the placement of concrete.
4. Prevent damaging waterstops during construction joint preparation.
5. Prevent splattering concrete on exposed/finish surfaces.
6. Provide an operable backup vibrator on site to and during concrete placement.

3.3 FORMWORK INSTALLATION

A. Formwork – General:
1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Shored forms to be cambered to compensate for form deflection due to placement and hardening of concrete.
4. Carefully verify horizontal and vertical positions of forms. Correct misaligned or misplaced forms before placing concrete. Complete wedging and bracing before placing concrete.
5. Joints in form panels to be staggered and tight fitting. Solidly butt and align joints. Provide backup at joints as required to prevent leakage.
6. Apply form release agent in accordance with manufacturer’s recommendations prior to placement of reinforcing steel, anchoring devices, and embedded items.
7. Install chamfer strips on external corners of beams, columns, pedestals, trenches, and as shown on Drawings.
8. Where shown on Drawings, install void forms in accordance with manufacturer’s recommendations.
    a. Install in straight alignment for the entire length of the members with tight fit joints.
    b. Void forms to be firmly held in place to prevent displacement before and during concrete placement.
    c. Provide with inserts as required for the intended loading.

B. Forms for Smooth Finish Concrete:
1. Use steel, plywood or lined board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.
3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full size sheets of form lines and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Use care in forming and stripping wood forms to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

C. Forms for Surfaces to Receive Membrane Waterproofing: Use plywood or steel forms. After erection of forms, tape form joints to prevent protrusions in concrete.

3.4 INSTALLATION – INSERTS, EMBEDDED PARTS, AND OPENINGS FOR FORMWORK

A. Install formed openings for items to be embedded in or passing through concrete work.

B. Coordinate with Work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

C. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, water stops, and other features.
2. Do not embed wood or uncoated aluminum in concrete.
3. Securely anchor embedded items in correct location and alignment prior to placing concrete.
4. Verify conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 for size and location limitations.

D. Openings for Items Passing Through Concrete:
1. Frame openings in concrete where indicated on Drawings. Establish exact locations, sizes, and other conditions required for openings and attachment of work specified under other sections.
2. Coordinate work to avoid cutting and patching of concrete after placement.
3. Pipes and conduit passing through slabs, grade beams, and walls to pass through sleeved holes sized 1 inch in diameter larger than the outside diameter of the pipe/conduit. Sleeves to extend the full thickness of the section.

E. Form Ties:
1. Use sufficient strength and sufficient quantity to prevent spreading of forms.
2. Place ties at least 1 inch away from finished surface of concrete.
3. Leave inner rods in concrete when forms are stripped.
4. If necessary to grease tie threads, do not allow grease to contact remainder of tie when wall will be exposed to hydrostatic pressure.
5. Column clamps to be used in lieu of form ties at square and rectangular columns.

F. Construction Joints:

1. Install surfaced pouring strip where construction joints intersect exposed surfaces to provide straight line at joints.
2. Show no overlapping of construction joints. Construct joints to present same appearance as butted plywood joints.
3. Arrange joints in continuous line straight, true and sharp.

G. Screeds:
1. Set screeds and establish levels for tops of concrete slabs and levels for finish on slabs.
2. Slope slabs to drain where required or as shown on Drawings.
3. For concrete over waterproof membranes and vapor retarder membranes, use cradle, pad or base type screed supports which will not puncture membrane.
4. Staking through membrane is not to be permitted.

3.5 FORM CLEANING

A. Clean forms and formed cavities of debris and rubbish, spilled concrete, sloughed soil, mud, standing water, ice or snow, tie wire trimmings, etc. prior to placing concrete.

B. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

C. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.6 FORM REMOVAL

A. Prior to removal of non-weight supporting forms:
1. Concrete to be hardened sufficiently to resist damage from removal operations, but in no case sooner than 24 hours.

B. Prior to removal of weight supporting forms:
1. Concrete compressive strength to be at least 100 percent of compressive strength as determined from field-cured test cylinders, unless otherwise approved by the Engineer.

C. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

D. Remove formwork progressively so no unbalanced loads are imposed on structure. Do not damage concrete surfaces during form removal.

E. Obtain Engineer’s permission for early removal of weight supporting formwork.

3.7 PLACING REINFORCING

A. Place, support and secure reinforcement against displacement. Do not deviate from required position beyond specified tolerance as defined in ACI 301 and CRSI MSP-1. Do not weld crossing reinforcement bars for assembly.

B. Do not displace or damage vapor retarder.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcement in accordance with ACI 318 and applicable building code.

E. Reinforcing steel splices to be lap type unless detailed otherwise on the Drawings.

F. Continuous horizontal bars to be installed in the longest possible lengths with ACI Class B lap splices in accordance with ACI 318 unless detailed otherwise on the Drawings.

G. Spiral lap splices to be 48 bar diameters minimum or 12 inches, whichever is greater, unless detailed otherwise on the Drawings. Spirals to be provided with spacers in accordance with CRSI MSP-1.

H. Reinforcing steel to be supported by use of bar supports at 4 feet on center maximum in any direction.

I. Field bending of reinforcing steel not shown on the Drawings to be subject to prior review of the Engineer. Do not heat reinforcing bars for bending purposes.

J. Welded Wire Fabric: Position fabric by supports spaced such that construction loads, including workers, do not cause permanent deflection of more than ½ inch.

3.8 PLACING CONCRETE

A. Place concrete in accordance with ACI 301 and ACI 318.

B. Notify testing laboratory and Owner’s Authorized Representative minimum 24 hours prior to commencement of operations.

C. Ensure reinforcement, inserts, embedded parts, formed expansion and contraction joints, and similar are not disturbed during concrete placement.

D. Repair vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

E. Water may not be added to the mix at the site unless approved by the Engineer. In no case is the maximum water/cement ratio be exceeded.

F. Raking or flowing of concrete to move it or re-tempering of concrete is not permitted.

G. Concrete to be conveyed/placed at a regular rate, as close as possible to final position. Prevent segregation of mix, and sequence in a manner which minimizes shrinkage. Concrete conveying equipment not to be supported on the reinforcing steel or supporting accessories.

H. The use of aluminum equipment for conveying concrete and finishing is not permitted.

I. Use tremies or other Engineer-approved method when drops over 5 feet are required and concrete will have to pass through obstructions, such as reinforcing.

J. Unless otherwise specified, consolidate concrete by vibration. Consolidate concrete around reinforcement, embedded items and into corners of forms to eliminate honeycombing or planes of weakness due to air voids and stone pockets. Unless otherwise specified, use the largest and most powerful internal vibrators to consolidate the concrete. Workers shall be experienced in the use of vibrators. Do not use vibrators to move concrete within the forms. Use immersion-type vibrators with nonmetallic heads when consolidating concrete around epoxy-coated reinforcement. Spacing of immersion vibrator insertions shall not exceed 1-1/2 times the vibrator's radius of action in the concrete being consolidated.

K. Place concrete in continuous operation for each panel or section determined by joints shown on the Drawings or as specified in these Specifications. Construction joints not shown on the Drawings or specified in these Specifications to be subject to prior review by the Engineer.

L. Do not interrupt successive placement; do not permit cold joints to occur.

M. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

3.9 FLOOR FINISHING

A. Finish concrete floor surfaces in accordance with ACI 301 and ACI 302.1.

B. Float finish surfaces scheduled to receive roofing, waterproofing membranes, and sand bed terrazzo. Power float and/or hand float surface.

C. Broom finish exposed exterior walking surfaces, ramps and outside paving, unless noted otherwise on the Drawings.

D. Screed slabs on grade level. Temporary screeds to be used. Wet screeding and jitterbugging is not permitted.

E. Saw-cut joints within 12 hours after placing. Use 3/16-inch-thick blade, cut into 1/4 depth of slab thickness unless otherwise shown on Drawings.

F. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains at 1/8 inch per foot nominal or as indicated on Drawings.

3.10 CURING

A. General:
1. Cure concrete in accordance with ACI 308.1, except as noted.
2. Start curing as soon as concrete surface will not be damaged by curing operations.
3. Continuously cure concrete, except high early strength concrete, for at least 7 consecutive days.
4. Cure high early strength concrete for at least 5 consecutive days.
5. During curing period, do not allow any part of concrete to become dry.
6. Keep forms in contact with concrete wet during curing period unless type of form is impervious to water, such as metal or fiberglass.
7. If forms are removed before curing period is complete, continue curing immediately with one of following methods.

B. White Burlap-Polyethylene Sheeting:
1. Saturate burlap-polyethylene and place burlap-side down over floor slab areas.
2. Lap ends and sides 6 inches minimum. Laps and edges to be sealed and secured in such a manner as to prevent moisture escaping from concrete.

C. Polyethylene Film: Spread over floor slab areas, lap edges and sides, seal with pressure sensitive tape and cover with plywood.

D. Membrane Curing Compound: Apply curing compound in one coat.
1. Apply curing compound at coverage rate of 300 square feet maximum per gallon for broomed finish and abrasive aggregate finish.
2. For troweled finish and other finishes where curing compound can be used, apply curing and sealing compound at coverage rate of 400 square feet per gallon or the strippable curing compound at 300 square feet per gallon.
3. Do not use liquid curing compound on surface against which additional concrete, other finishing materials, coatings, tank linings or slab toppings are to be bonded if their bond will be affected by curing compound.
4. High solids content of curing compound may clog hand sprayers; plan for this by using power sprayer or other means of application as specified by the manufacturer if necessary.
5. For surfaces subjected to rainfall, immediately recoat at the rate specified above, within 3 hours after compound has been applied or surfaces damaged by subsequent construction operations within the curing period.

E. Non-Membrane Forming Curing Compound: Apply curing compound in one coat Scrub compound into surface. Maintain surface wet with curing compound, without ponding for time recommended by manufacturer.

3.11 FIELD QUALITY CONTROL

A. Concrete inspections to be performed in accordance with ICC International Building Code and as noted on Drawings.

B. Sampling and Testing:

1. Sampling Procedures: ASTM C172.
   a. Cylinder Molding and Curing Procedures: ASTM C31 cylinder specimens, field cured.
   b. Sample concrete and make one set of four standard 6-inch (150mm) diameter by 12-inch cylinders for every 75 cubic yards or less of each class of concrete placed each day and for every 5,000 square feet of surface area for slabs and walls.
   c. All field-cured samples to be field-cured the same as the concrete they represent.
   d. When volume of concrete for any class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch when less than five batches are used.
   e. Make one additional cylinder during cold weather concreting, and field cure.
   f. Use standard-cured cylinders for acceptance testing for specified strength.
   g. Cylinders for substantiation of concrete strength for other construction purposes to be in addition to cylinders required for strength acceptance.
2. Field Testing:
   a. Slump Test Method: ASTM C143.
   b. Air Content Test Method: ASTM C173.
   c. Temperature Test Method: ASTM C1064.
   d. Measure slump and temperature for each compressive strength concrete sample.
   e. Measure air content in air entrained concrete for each compressive strength concrete sample.
3. Cylinder Compressive Strength Testing:
   a. Test Method: ASTM C39.
   b. Test Acceptance: In accordance with ACI 318.
   c. Test one cylinder at 7 days.
   d. Test two cylinders at 28 days when 6”x12” samples taken. Test three cylinders at 28 days when 4”x8” samples are taken.
   e. Test one cylinder at 56 days only if 28-day tests are below the specified strength.
   f. Dispose remaining cylinders when testing is not required.
4. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
5. Core Compressive Strength Testing:
   a. Sampling and Testing Procedures: ASTM C42.
   b. Test Acceptance: In accordance with ACI 318.
   c. Drill three cores for each failed strength test from concrete represented by 28 and 56-day compressive strength tests that are below the specified strength.
   d. Reinforcing steel locations to be determined prior to coring. Cutting of reinforcing steel due to coring is not permitted.
6. Penetration resistance tests of concrete for indication of compressive strength to be in accordance with ASTM C803.
   a. Test to be made on concrete where the 28 and 56-day compressive strength tests are below the specified strength.

b. Test to be made within 24 hours of the noncomplying cylinder tests.

7. Core compressive strength and penetration resistance tests to be made at the Contractor's expense without additional cost to the Owner.
8. Provide the following within 48 hours after completion of tests and inspections:
   a. Test reports concerning slump, air content, temperature and compressive strengths of concrete and ambient temperature at the time of placement.
   b. Inspection reports concerning concrete placement and slab surface flatness.

3.12 REINFORCING REPAIR

A. Abraded and scarred areas on epoxy-coated surfaces as defined in CRSI Guidelines for Epoxy-Coated Reinforcing (including cut ends) to be repaired with patching compound with a minimum dry film thickness of 10 mils.

3.13 PATCHING AND CLEANING

A. Honeycomb voids, rock pockets, and form tie holes to be cleaned to sound concrete and filled with grout or patching mortar mixed with diluted non-reemulsifiable bonding agent. Fins and projections to be removed.

B. Patch imperfections in accordance with ACI 318 as directed by Engineer.

C. Surface repairs to match the finish of the adjacent concrete surface and not to be visible at surfaces exposed to view.

D. Clean all concrete splatter from exposed/finish surfaces. All cleaned surfaces to be equal to the original surface and splatter not to be visible.

3.14 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

B. Need to repair or replacement of defective concrete will be determined by Owner's Authorized Representative. Additional inspections due to and correction of non-complying surfaces to be made at the Contractor's expense without additional cost to the Owner.

C. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Owner for each individual area.

3.15 PROTECTION

A. Barricade concrete surfaces immediately after finishing.

B. Do not permit light traffic, except for curing purposes, over unprotected floor surface until concrete has obtained 60 percent of its specified compressive strength (7 days minimum) determined by field-cured test cylinders.

C. Do not permit heavy traffic over unprotected floor surface until concrete has obtained its specified design strength determined by field-cured test cylinders. Ensure construction traffic does not exceed floor design loads.

D. If concrete has been cured by water or sheet material, permit concrete to dry minimum of 2 additional days after curing is completed before removing barricades.

E. Finish slabs to be protected from traffic, mud, dirt, concrete splatter, joint compound, sealants, paint, oil, grease, etc., during construction by use of a durable waterproof craft paper.

F. Earth backfill behind walls not to be placed until the concrete has attained 100 percent of its specified 28-day compressive strength as substantiated by field-cured test cylinders.

G. Walls with earth backfill behind and tied to slabs to be braced, and removal of bracing not to be allowed until the slab is complete and has attained 100 percent of its specified 28-day compressive strength as substantiated by field-cured test cylinders, unless otherwise approved by the Engineer.

3.16 TESTING OF LIQUID-HOLDING CONCRETE STRUCTURES

A. General:
1. Test concrete tanks, clarifiers and other liquid-holding structures for liquid tightness prior to backfilling, application of waterproofing, or application of any lining, coating or other finishing material to concrete, unless otherwise allowed by Owner.
2. Notify Owner one week minimum in advance of beginning testing.
3. Conform to requirements of Watertightness Test Requirements, attached.

3.17 FLOOR SEALING

A. Unless coating, topping, wax, is to be added to floor surface later, just prior to completion of construction apply uniform coat of liquid sealer/densifier to trowel finished interior floor surfaces in accordance with manufacturer's recommendations.

B. Apply compound after slab repairs and sealing of joints have been completed.

C. Remove stains and thoroughly clean and dry surfaces immediately prior to application.

D. Apply this compound on exposed interior floors subjected to vehicular abrasion and shake on hardener slabs as indicated on the drawings. Application to be made in accordance with the directions of the manufacturer and just prior to completion of construction. Spray, squeegee, or roll on liquid densifier to clean, dry concrete surface. The liquid should be scrubbed into the surface with a mechanical scrubber. Keep the surface wet with the densifier during the application process. When the product thickens, but not more than 60 minutes after initial application, the surface to then be squeegeed or vacuumed to remove all excess liquid.

3.18 SUBMITTAL SCHEDULE

ITEM NO.	SUBMITTAL REQUIREMENT	WITH BID	AS INDICATED
03 30 00-1	Reinforcing: Shop Drawings: Indicate bar sizes, spacings, locations, splice lengths and locations and bending diagrams, and welded wire fabric. Certificates: Submit AWS qualification certificate for welders employed on the Work. Submit certified copies of mill test report of reinforcement materials analysis.		Two weeks prior to fabrication or purchase
03 30 00-2	Concrete: Product Data: Submit data on joint devices, attachment accessories, and admixtures. Design Data: Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following: Hot or cold weather concrete work. Air entrained concrete work. Identify mix ingredients and proportions, including admixtures. Identify chloride content of admixtures and whether or not chloride was added during manufacture.		Two weeks prior to fabrication or purchase
03 30 00-3	Watertightness Test Container: Submit proposed container information for watertightness testing.		Two weeks prior to fabrication or purchase
03 30 00-4	Watertight Structure Repair Materials and Procedures: Submit repair materials and procedures for watertight structures.		Two weeks prior to fabrication or purchase
03 30 00-5	Finishing: Submit data on concrete hardener, compatibilities, and limitations.		Two weeks prior to construction
03 30 00-6	Curing: Submit data on curing compounds, compatibilities, and limitations.		Two weeks prior to construction

ATTACHMENT
WATERTIGHTNESS TEST

A. GENERAL
1. Perform test on concrete liquid-holding structures, unless otherwise allowed by Owner.
2. Test structure to not have leakage rate in excess of criteria given below.
3. Exclude or minimize those factors that affect water surface elevation during test and are not due to leakage.
4. Eliminate or minimize loss of water from structure due to items or elements that are not considered part of actual structural containment.
5. Do not simultaneously test structures with common walls.
6. Notify Owner's Representative 2 weeks prior to starting test so Owner's Representative can be present during testing.

B. STRUCTURE AND SYSTEM CONDITION
1. Holding structure to be structurally complete and capable of resisting hydrostatic pressure of test water.
2. Do not install waterproofing, linings, coatings or other finishing material until after testing is complete and accepted, unless otherwise allowed by Owner.
3. Do not allow backfill to be present around structure (provided design of structure included this condition), unless otherwise allowed by Owner.
4. During entire test period, dewater as necessary to lower ground water at structure below containment floor and below any underdrain system.
5. Expose to view underdrain discharge line or point, adjacent to structure, in order that flow in system can be monitored during test.
6. Check temporary bulkheads, cofferdams, pipe blind flanges, and closed valves to see they form a complete seal at these outlets and, where possible, observe these outlets during actual test.

C. TEST PROCEDURE
1. Test Preparation:
   a) Do not place backfill around holding structure prior to test.
   b) Provide open inspection access points to piping, channels and conduits that leave structure, including any underdrain outlets.
   c) When structure has gained sufficient strength to withstand test load and after outlets have been securely sealed, fill structure with water.
   d) During filling monitor outlets for watertightness, underdrain outlets for any increase in flow, and structure, especially concrete joints and cracks, for any visible leakage from structure.
   e) If any visible leakage from structure or increase in flow from underdrain system is observed, correct condition prior to start of test measurements.
   f) Make no allowance in test measurements for uncorrected point source leakage.
   g) When test preparations are acceptable to Owner's Representative, keep structure full of water for minimum of 3 days prior to starting test.
2. Test Measurements:
   a) Measure height of water surface in structure at 4 points, 90 degrees apart, at start of test in order to minimize effect of differential settlement of tank on computed values.
   b) Unless otherwise required by Owner, record water temperature at depth approximately 18 inches below water surface at start and end of test.
   c) If required by Owner, also record water temperature at 5-foot depth intervals at start and end of test.

d) Position floating, transparent, partially filled, calibrated, open container for evaporation/precipitation measurement in uncovered liquid containment structures and, if directed by Owner, covered structures.
e) Submit container information to Owner's Representative for acceptance.
f) Record water level in floating container at start of test.
g) Position container away from sides of structure and any overhead members that may shield or shade container.
h) Provide sufficient freeboard for container to accommodate precipitation from normal rainfall and not be overtopped by waves generated by wind.
i) Record measurements at 24-hour intervals, plus or minus 1 hour.
j) Inspect structure exterior (especially joints and cracks), outlets, underdrain system, etc., daily for dampness or other indications of leakage.
k) Continue test for period of time sufficient to produce at least 1/2-inch drop in water surface based on leakage occurring at maximum allowable rate (see examples below).

3. At end of test period:
   a) Record water surface elevation at location of original measurements.
   b) Record water temperature and water surface elevation in evaporation/precipitation measurement device.
   c) Compute leakage rate from tank, corrected for evaporation/precipitation as applicable and, if required by Owner, temperature.
   d) Submit calculations and measurements to Owner's Representative for acceptance.
   e) If leakage rate exceeds criteria below, structure has failed test.
   f) Structure has also failed test if water is observed flowing from structure, underdrain system and/or related systems (other than from underdrain system if ground water cannot be lowered below system) or if moisture, other than from precipitation or condensation, can be transferred to a dry hand from exterior surfaces.
4. Repairs:
   a) Submit repair materials and procedures to Owner for acceptance and retest any structure failing test, including dewatering structure and inspecting interior for defects that allow leakage, if required.
   b) All repairs and additional testing to be done at no cost to Owner.

D. QUANTITATIVE CRITERIA
1. Allowable leakage rate for unlined concrete liquid-holding structures and those with coatings only, with sidewater depth of 25 feet or less, not to exceed 0.1 percent of water volume in 24 hours.
2. Allowable leakage rate for concrete liquid-holding structures, with lined walls only and sidewater depth of 30 feet or less, not to exceed 0.06 percent of water volume in 24 hours.
3. Allowable rate of concrete liquid-holding structures, with lined floors only and sidewater depth of 30 feet or less, not to exceed 0.04 percent of water volume in 24 hours.
4. Allowable leakage rate for fully lined concrete liquid-holding structures, with sidewater depth of 30 feet or less, not to exceed 0.025 percent of water volume in 24 hours.
5. Allowable leakage rate for concrete liquid-holding structures with greater sidewater depths than indicated above are as selected by Owner.

E. TEST DURATION EXAMPLE

Example 1
Structure is flat bottom, unlined, reinforced concrete tank with 20-foot water depth. Allowable leakage rate is 0.1 percent of water volume in 24 hours.

Duration of test:

$$\frac{0.5 \text{ in.}}{0.001 \text{ in./in./day} \times 20 \text{ ft.} \times 12 \text{ in./ft.}} = 2.08 \text{ days}$$

Measurements are taken at 24-hour intervals; therefore test duration is 3 days

minimum. Example 2
Structure is conical or pyramidal bottom, unlined, reinforced concrete tank with 15-foot sidewater depth and maximum depth of 21 feet. Allowable leakage rate is 0.1 percent of water volume in
24 hours.

Equivalent depth
A = surface
d = equivalent depth

$$d = \frac{15 \text{ ft.} \times A \text{ ft.}2 + (21 \text{ ft.} - 15 \text{ ft.}) A \text{ ft.} 2}{3 A \text{ ft.} 2}$$

=15+2=17 feet

Duration of test:

$$\frac{0.5 \text{ in.}}{0.001 \text{ in./in./day} \times 17 \text{ ft.} \times 12 \text{ in./ft.}} = 2.45 \text{ days}$$

Measurements are taken at 24-hour intervals; therefore test duration is 3 days minimum.

END OF SECTION 033000

SECTION 033543 - POLISHED CONCRETE FINISHING

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 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 302.1R Guide for Concrete Floor and Slab Construction.

B. ASTM International:
   1. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   2. ASTM C171 Standard Specification for Sheet Materials for Curing Concrete.
   3. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
   4. ASTM D523 Standard Test Method for Specular Gloss

C. National Floor Safety Institute (NFSI):
   1. NFSI Test Method 101-A Standard for Evaluating High-Traction Flooring Materials, Coatings, and Finishes.

1.3 SUMMARY

A. Section includes polished concrete finishing including staining and scoring.

   1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."

B. Related Requirements:

   1. Section 033000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

1.4 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Installer to have a minimum of 5 years' experience.

B. exceeding the requirements of this project.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Repair materials.
2. Liquid floor treatments.

1.7 QUALITY ASSURANCE

A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.

1. Locate panels as indicated or, if not indicated, as directed by Architect.
2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
3. Demolish and remove field sample panels when directed.

B. Mockups: Before casting concrete, build mockups to verify selections made under Sample submittals and to demonstrate typical joints, surface finish, tolerances, and standard of workmanship. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Demonstrate curing, finishing, and protecting of polished concrete.

C. Warranty
1. Provide 20 year manufacturer's material warranty commencing at date of building substantial completion. Manufacturer shall warrant to the owner that polished surface will remain water repellent, dustproof, hardened and abrasion resistant.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARDEX GmbH. –Ardex PC Finish
2. Euclid Chemical Company (The); an RPM company. –Euco Tammoshield
3. Sherwin Williams - SherCrete Concrete Hardener 888-765-4771
4. Vexcon Chemicals Inc. –Certi-Shine Clear

2.2 STAIN MATERIALS

A. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

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. Bomanite Co.
b. Increte Systems Inc.
c. Sherwin Williams
d. SureCrete Design Products.

2. Color to be selected by the Architect from the manufacturer standard color.

PART 3 - EXECUTION

3.1 POLISHING

A. Polish: Level 3: High sheen, 800 grit.

B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
2. Apply reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
6. Control and dispose of waste products produced by grinding and polishing operations.
7. Neutralize and clean polished floor surfaces.

3.2 STAINING

A. Newly placed concrete shall be at least 14 days old before staining.

B. Prepare surfaces according to manufacturer's written instructions and as follows:

1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.

    a. Do not use acidic solutions to clean surfaces.

2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by acid etching. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
3. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.
4. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.

C. Scoring: Score decorative jointing in concrete surfaces 1/16 inch deep with diamond blades to match pattern indicated. Rinse until water is clear. Score before staining.

1. Joint Width: 3/8 inch.

D. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D 4263 by tightly taping 18-by-18-inch, 4-mil- thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

E. Reactive Stain: Apply reactive stain to concrete surfaces according to manufacturer's written instructions and as follows:

1. Apply stain by uncolored bristle brush, roller, or high-volume, low-pressure sprayer and immediately scrub into concrete surface with uncolored, acid-resistant nylon-bristle brushes in continuous, circular motion. Do not spread stain after fizzing stops. Allow to dry four hours and repeat application of stain in sufficient quantity to obtain color consistent with approved mockup.
2. Remove stain residue after four hours by wet scrubbing with commercial-grade detergent recommended by stain manufacturer. Rinse until water is clear. Control, collect, and legally dispose of runoff.

END OF SECTION 033543

SECTION 036000 GROUT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:
1. Portland cement grout.
2. Non-shrink cementitious grout.

B. Related Sections:
1. Section 03 30 00 – Cast-In-Place Concrete.

C. Mandatory Provisions: In publications referred to, advisory provisions are considered to be mandatory; for example, substitute word “shall” for “should” whenever it appears.

1.2 REFERENCES

A. Abbreviations and Acronyms:
1. American Concrete Institute (ACI).
2. American Society of Testing and Materials (ASTM).

B. American Concrete Institute:
1. ACI 301 – Specifications for Structural Concrete.
2. ACI 305.1 – Specification for Hot Weather Concreting.
3. ACI 306.1 – Standard Specification for Cold Weather Concreting.
4. ACI 318 - Building Code Requirements for Structural Concrete.
5. ACI 351.1R – Report on Grouting Between Foundations and Bases for Support of Equipment and Machinery.

C. American Society of Testing and Materials:
1. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
2. ASTM C150 – Standard Specification for Portland Cement.
3. ASTM C1602 – Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
4. ASTM C33 – Standard Specification for Concrete Aggregates.
5. ASTM C40 – Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.
6. ASTM C1107 – Standard Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone.
7. ASTM C827 – Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

D. U. S. Army Corps of Engineers Concrete Research Division (CRD):
1. CRD C621 – Non-Shrink Grout.

1.3 SUBMITTALS

A. Refer to the Submittal Schedule at the end of Part 3 for a list of submittal requirements for this Section.

1.4 QUALITY ASSURANCE

A. Grout Pre-Construction Meeting:
   1. For Work specified herein, attend grout pre-construction meeting scheduled at least 14 days before starting grouting.
   2. Attendees to include representatives designated and technical representatives of grout manufacturers.
   3. Representatives to be personnel who are directly involved in Project and who have authority to control Work.

B. Grouting: Correct grouting which does not conform to specified requirements including strength, shrinkage, flowability, and bleeding as directed at no additional cost and no extension of Contract time.

C. Testing/inspection agencies shall be in conformance with ASTM E329.

D. Maintain one copy of each document on site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver grout in manufacturer's unopened containers with proper labels and protective packaging intact.

B. Store grout off the ground in a dry shelter; protect grout from moisture while stored and handled.

C. Store coarse aggregate on a smooth hard surface and protect from mixture with foreign materials.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not perform grouting if temperatures exceed 90 degrees F.

B. Do not perform grouting during freezing conditions, rain, sleet, snow, or wind unless proper provisions/arrangements are provided.

C. Maintain minimum temperature of 40 degrees F before, during, and after grouting, until grout has set.

D. Grout shall not be placed on or against frosted surfaces.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT GROUT

A. Portland Cement: ASTM C150, Type I, I-II, or II.

B. Water: ASTM C1602.

C. Fine Aggregate:
1. Washed natural sand.
2. Gradation in accordance with ASTM C33 and represented by smooth granulometric curve within required limits.
3. Free from injurious amounts of organic impurities as determined by ASTM C40.

D. Mix:
1. Portland cement, sand and water. Do not use ferrous aggregate or staining ingredients in grout mixes. See MIXING in Part 3 of this Section.

2.2 NON-SHRINK CEMENTITIOUS GROUT

A. Manufacturer: Masterflow 928 by Master Builders or approved equivalent for column bases.

B. Manufacturer: Masterflow 648 by Master Builders or approved equivalent for equipment bases.

C. Non-Shrink Cementitious Grout: Pre-mixed ready for use formulation requiring only addition of water; non-shrink, non-corrosive, non-gas forming, no chlorides.

D. Grout to maintain flowable consistency for minimum 30 minutes minimum when tested in accordance with ASTM C827.

E. Properties: Certified to maintain initial placement volume or expand after set and meet the following minimum properties when tested in accordance with CRD-C621, for Grades B and C non-shrink grout:

Property	Test	Time	Result
Setting Time	ASTM C191	Initial	2 hours (approximate)
		Final	3 hours (approximate)
Expansion			0.10% - 0.4% Maximum
Compressive Strength	CRD-C621	1 day	4,000 psi
		7 days	7,000 psi
		28 days	8,000 psi

2.3 FORMWORK

A. Refer to Section 03 30 00 – Cast-In-Place Concrete for formwork requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify areas to receive grout.
   1. Concrete to be grouted against shall be a minimum of 7 days old.

B. Surfaces to be grouted against shall be free from dirt, mud, dust, oil, grease, wax, curing compound, bond breaker, laitance and/or unsound material, loose or non-adherent rust, loose mill scale, paint/primer, and any foreign matter or coating that adversely affects the bonding capacity to the surfaces.

3.2 PREPARATION

A. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by brushing, hammering, chipping or other similar means until sound, clean concrete surface is achieved.

B. Roughen concrete to a minimum of 1/4-inch amplitude, but not enough to interfere with placement of grout.

C. Remove foreign materials from metal surfaces in contact with grout.

D. Align, level and maintain final positioning of components to be grouted.

E. Saturate concrete surfaces with clean water; remove excess water, leave none standing.

F. Protect exposed/finish surfaces against splattering grout.

G. Form Construction Preparation:
   1. Vent grout space to eliminate air pockets.
   2. Forms shall be of sound and sufficiently strong material.
   3. Forms shall be sufficiently tight to prevent leakage of grout.
   4. Forms shall be adequately braced and tied together.
   5. Forms shall extend 1inch minimum above bottom of baseplates.

H. Field-Mixed Sand-Cement Grout:
   1. Roughen concrete surface to be grouted and remove laitance, foreign matter, curing compound, and loose particles.
   2. For at least 6 hours before placing grout, saturate with water all concrete surfaces to be in contact with grout but standing water shall not be permitted on the surfaces.
   3. Remove excess water from anchor bolt holes and surfaces to be grouted and ensure surfaces are damp only, with no surface water, just before placing grout.

3.3 INSTALLATION – FORMWORK

A. Construct leak proof forms anchored and shored to withstand grout pressures.

B. Install formwork with clearances to permit proper placement of grout. Forms shall extend 1inch minimum above bottom of baseplates.

C. Exposed corners/edges shall be beveled with 3/4-inch by 3/4-inch chamfer strips.

D. Vent grout space to eliminate air pockets.

3.4 MIXING

A. Portland Cement Grout:
1. Use proportions of 2 parts sand and 1part cement, measured by volume.
2. Prepare grout with water to obtain consistency to permit placing and packing.
3. Mix water and grout in two steps; pre-mix using approximately 2/3 of water; after partial mixing, add remaining water to bring mix to desired placement consistency and continue mixing 2 to 3 minutes.
4. Mix only quantities of grout capable of being placed within 30 minutes after mixing.
5. Do not add additional water after grout has been mixed.

B. Mix and prepare non-shrink cementitious grout in accordance with manufacturer's instructions.

C. Mix grout components in proximity to work area and transport mixture quickly and in manner not permitting segregation of materials.

3.5 PLACING GROUT

A. Place Portland cement grout in accordance with ACI 301. Place cementitious grout in accordance with the manufacturer’s instructions.

B. Place grout material quickly and continuously. Grout shall not be retempered after initial mixing.

C. Do not use pneumatic-pressure or dry-packing methods. Grout shall be placed with a flowable or plastic consistency as best suits the situation. Grout with a plastic consistency shall be consolidated every 3 inches minimum.

D. Apply grout from one side only to avoid entrapping air and material segregation.

E. Do not vibrate placed grout mixture, or permit placement when area is being vibrated by nearby equipment.

F. Thoroughly compact final installation and eliminate air pockets. Compact grout by rodding; do not vibrate.

G. Do not remove leveling shims for at least 48 hours after grout has been placed. If shims are removed or leveling nut or leveling screws are backed off, provide adequate constructability by greasing them, providing sufficient accessibility and other requirements for constructability.

H. Extend grout on open sides of baseplates a minimum distance equal to the thickness of the grout section.

I. Unplaced grout that has taken its initial set, has been retempered, has been contaminated by foreign materials, or has fallen on the ground shall not be placed.

3.6 CURING

A. Immediately after placement, protect grout from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. After grout has attained its initial set, keep damp for minimum of 3 days.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed in accordance with ACI 318.

B. Submit proposed mix design of each class of grout to inspection and testing firm for review prior to commencement of Work.

C. Tests of grout components may be performed to ensure conformance with specified requirements.

D. Sampling of grout, making and curing of grout prisms for compressive strength tests, and testing of compressive strength specimens shall be in accordance with the applicable provisions of ASTM C109.

E. One sample of grout for compressive strength tests shall be taken for every 25 cubic feet or fraction thereof of grout placed each day.

F. Four standard 2-inch by 2-inch by 2-inch prisms shall be made at each sampling.

G. Compressive strength tests shall be made at 3 days using one prism and at 7 days using two prisms. The fourth prism shall be tested at 28 days only if the 7-day tests are below the specified strength.

3.8 PROTECTION

A. Grout shall be protected from construction operations, mechanical disturbances, water flow, and the weather for a minimum of 3 days after placement.

3.9 FINISHING

A. Forms shall not be removed until the grout has taken its initial set, but not less than 2 hours after grout placement.

B. Exposed grout surfaces shall have a smooth form or troweled finish.

3.10 CLEANING

A. Clean grout splatter from exposed/finish surfaces. Cleaned surfaces shall be equal to the original surface and shall not be visible.

3.11 SHIM AND WEDGE REMOVAL

A. After grout has gained sufficient strength to not be damaged, remove shims and wedges from under bases of equipment.

B. After grout has gained sufficient strength to not be damaged, remove shims and wedges from under column base plates and bearing devices for structural work where they are supported by piers or walls.

C. Patch voids with same type of grout.

3.12 LEVELING NUT OR LEVELING SCREW BACK-OFF

A. After grout has gained sufficient strength to not be damaged, back off leveling nuts or leveling screws under bases of equipment such that they do not bear on concrete or steel.

B. After grout has gained sufficient strength to not be damaged, back off leveling nuts or leveling screws under bearing devices for structural work where they are supported by piers or walls.

C. Patch voids with same type of grout.

END OF SECTION 036000

SECTION 042200

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies the requirements necessary to furnish and install:
1. Concrete Unit Masonry, including split face units
2. Reinforcement and accessories.
3. Mortar.
4. Grout.

B. Related Sections:
1. Section 05 12 00 – Structural Steel: Product requirements for steel anchors by this section.
2. Section 07 90 00 – Joint Protection.

1.2 REFERENCES

A. Work and materials included in this Section shall conform to the following in addition to the Contract Documents.

B. American Concrete Institute:
1. ACI 216.1 – Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies.
2. ACI 530 – Building Code Requirements for Masonry Structures.
3. ACI 530.1 – Specifications for Masonry Structures.
4. ACI 117 – Standard Tolerances for Concrete Construction and Materials.

C. ASTM International:
1. ASTM C55 – Concrete Building Brick.
2. ASTM A82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement
3. ASTM C90 – Hollow Load-Bearing Concrete Masonry Units.
4. ASTM C140 – Sampling and Testing Concrete Masonry Units Project/Site Conditions.
5. ASTM C404 - Standard Specification for Aggregates for Masonry Grout
6. ASTM C476 – Standard Specification for Grout for Masonry

D. Concrete Reinforcing Steel Institute:
1. CRSI MSP-1 – Manual of Standard Practice.

E. NRMCA National Ready Mixed Concrete Association:
1. Ready Mixed Concrete Batch Plants.

1.3 QUALITY ASSURANCE

A. Joint reinforcing and insulation inserts shall be ICBO approved.

B. Testing and inspection agencies shall be in accordance with ASTM E329.

C. Hollow unit masonry used for 2 and 1-hour area separation walls shall meet Underwriters Laboratories (UL) requirements for -2 and 1-hour fire rating.

D. Apply label from agency approved by authority having jurisdiction to identify each masonry core insulation insert.

E. Moisture Penetration Test Sample:
1. Construct and test a masonry unit sample panel at a qualified testing laboratory using procedures outline in ASTM E514. Approved sample shall be tested using the Rilem tube test. Field tests shall be compared to the laboratory test results.
2. Rilem tube test shall be used to verify that the level of moisture absorption conforms to standards identified in this Section.

F. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Masonry units shall be pallet wrapped with a durable, waterproof covering and remain wrapped until time of placement.

B. Masonry units at the site shall be stored off the ground, protected from the weather, and stored and/or handled in such a manner as to prevent soiling, absorption of moisture, and/or damage.

C. Mortar aggregate shall be stored on a smooth hard surface and protected from mixture with foreign materials.

D. Reinforcing steel shall be delivered to the site in bundles marked with tags calling out quantity, bar size, length, grade, piece number, and bend diagram.

E. Reinforcing steel and accessories at the site shall be stored off the ground and stored and/or handled in such a manner as to prevent contamination, soiling, and/or damage.

F. Transporting of ready-mix grout shall be in accordance with ASTM C94.

1.5 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures: Requirements for submittals.

B. Section 01 70 00 – Execution and Closeout Requirements: Requirements for submittals.

C. Section 01 81 13 – Sustainable Design Requirements: Requirements for sustainable design submittals.

D. Refer to the Submittal Schedule at the end of Part 3 for a list of submittal requirements for this Section.

1.6 MOCK-UP

A. Locate where directed by the Owner, except as located on the Drawings

B. Construct 8-foot-wide by 6-foot-high mock-up of full-sized masonry units with 2-foot return, except as noted on the Drawings. Mock-up shall demonstrate systems, conditions, and components with specified unit sizes, finish, joint pattern, mortar color and wall opening conditions to illustrate a complete wall assembly. Fabricate mock-up representative of finished work. Mock-up shall match actual masonry configuration as indicated on the drawings. Reviewed mock-up assembly shall be used as standard for judging acceptability of project masonry work. If acceptable, mock-up may be incorporated as part of final construction.

C. Construct mock-up in accordance with specifications for its respective components and shall be representative of finish product to be achieved throughout the project. Remove and replace mock-up not acceptable to CEC until acceptable.

D. Surfaces not comparable to mock-up will be subject to CEC's rejection and shall be replaced at the Contractor's expense.

1.7 PRE-INSTALLATION MEETINGS

A. Convene meeting minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inspect units at the site for damage..

1.9 COORDINATION

A. Coordinate masonry work with architectural Drawings and other trades, including veneer, installation of window, door, and other anchors, plus electrical and mechanical work.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Grouting shall not occur for a minimum of 24 hours after lay-up of the walls.

B. Cold Weather Requirements: In accordance with ACI 530.1 when ambient temperature or temperature of masonry units is less than 40 degrees F.

C. Hot Weather Requirements: In accordance with ACI 530.1 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than [90 degrees F] with wind velocity greater than [8 mph] .

1.11 EXTRA MATERIALS

A. Supply adequate numbers of units as extra material to accommodate potential material loss during construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Hollow Masonry Units: Unless noted otherwise on the Drawings, ASTM C90, Grade S except Grade N for exterior and below grade applications .
   1. Minimum Compressive Strength: f'm=1,500 psi at 28 days.
   2. Aggregate: Siliceous concrete aggregate per ASTM C33 for normal weight aggregate; ASTM C331 for lightweight aggregate.
   3. Integral Block Sealer: Dry-Block additive.

B. Decorative Concrete Masonry Units: ASTM C90; normal weight; color as selected to the following design:
   1. Split face concrete masonry units, sized as indicated on the Drawings.

C. Masonry units at time of placement shall have been air cured for a minimum of 28 days or kiln cured with a moisture content of 30 percent maximum of total absorption and a linear shrinkage of 0.035 percent maximum in conformance with ASTM C426.

D. Concrete Masonry Unit Size and Shape: Nominal modular size of 16x8x12 inches . Furnish special units for 90-degree corners, bond beams, and lintels.

E. Portland Cement: ASTM C150, Type I or II.

F. Hydrated Lime: ASTM C207, Type S.

G. Aggregate for Mortar: ASTM C144.

H. Aggregate for Grout: ASTM C404.

I. Water: In conformance with ASTM C94.

J. Tie Wire: ASTM A853 16-gauge or heavier black soft-annealed wire.

K. Factory Applied Integral Block Sealer: Integral liquid polymeric admixture added to CMU to achieve a Class E rating when tested with ASTM E514; Dry-Block additive, W.R. Grace.

L. Waterproofing: SikaTop Seal 107, two-component, polymer-modified cementitious waterproofing.

2.2 EQUIPMENT

A. Ready-mix concrete batch plants shall conform to NRMCA concrete plant standards.

B. Ready-mix concrete trucks shall be mixer-agitator type. The use of nonagitator equipment shall not be permitted.

C. Ready-mix concrete trucks shall be equipped with operable electrically actuated drum revolution counters.

2.3 ACCESSORIES

A. Bar Positioners: By Dur-O-Wall, or by WCR Fabricators.

B. Control Joint Filler: Preformed regular type; Rapid Expansion Joint by Dur-O-Wall.

C. Expanded Metal Lath: Galvanized steel fine mesh type.

D. Single Wythe Joint Reinforcement: ASTM A951/A951M; truss type; steel ; 0.148-inch diameter side rods with 0.148-inch-diameter cross ties.

E. Steel Bar Reinforcement: ASTM A615, Grade 60 deformed bars.

F. Wall Ties: ASTM A82, cold-drawn steel wire, or ASTM A615, Grade 60 hot-rolled plain steel bar.

G. Adjustable Wall Ties: 3/16-inch diameter with mill-galvanized finish; two piece with pintle section and eye section.

H. Strap Anchors: 1-1/2-inch wide by 1/4-inch thick by 24 inches long; with ends turned up 2 inches or with cross pins; hot-dipped galvanized to comply with ASTM A 153.

I. Tie Wire: ASTM A853 16-gauge or heavier black soft-annealed wire.

J. Lap Sealant: Butyltype as specified in Section 07 90 00 – Joint Protection.

K. Preformed Control Joints: Polyvinyl chloridematerial. Furnish with corner and tee accessories, heatfused joints.

L. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding;

M. Nailing Strips: Softwood, preservative treated for moisture resistance, dovetail shape, sized to masonry joints.

N. Cavity Vents: Molded polyvinyl chloride grilles; insect resistant.

O. Veneer Anchors for Metal Studs:
1. Steel Drill Screws: ASTM C954 with hex-washer head and neoprene washer, #10 diameter by length required to penetrate stud flange by not less than 3 exposed threads.
2. Fastener Protection: Organic-polymer coating with salt-spray resistance to red rust of more than 800-hours per ASTM B117.
3. Neoprene Gaskets: Manufacturer's standard closed-cell-neoprene gaskets manufactured to fit behind anchor plate and to prevent moisture from penetrating through screw holes to studs behind sheathing.
4. Design Guide: DW-10X with Vee Wall-Tie anchor by Hohmann & Barnard, Inc.

P. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

Q. Steel Lintels: As Specified in Section 05 50 00 – Metal Fabrications.

2.4 MIXES

A. Mortar: ASTM C270, Type S, f'c equal 1,800 psi at 28 days. The use of masonry cement shall not be permitted.

B. Grout: ASTM C476, f'c equal 2,000 psi at 28 days.

C. The cement content and the water/cement ratio of grout shall be as set by the reviewed mix design meeting these Specifications.

D. Maximum Grout Aggregate Size: 3/8 inch minus.

E. Allowable Grout Slump: 9 inches, plus or minus 1 inch.

F. Grout Temperature as Delivered to the Site: 50 to 90 degrees F temperature range.

G. The use of admixtures, antifreeze compounds, air entrainment, or other substances in the mortar or grout shall be subject to prior review by CEC.

H. The use of frozen materials or materials containing ice or snow shall not be allowed, except as allowed concerning water for grout.

2.5 FABRICATION

A. Reinforcing steel shall be fabricated completely in the shop.

B. Reinforcing steel shall conform accurately to the dimensions as shown on the Drawings within the allowable tolerances as defined in ACI 530.1.

C. Hooks shall conform to the bend dimensions defined as ACI Standard Hooks in CRSI MSP-1.

D. Tie hooks shall have 135-degree end returns with 4-inch extensions.

E. Reinforcing steel shall be cold bent and shall not be bent in a manner that would damage the material. Reinforcing steel shall not be straightened or rebent.

F. Insulation inserts shall be installed at the time of manufacture of the masonry units.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive work.

B. Verify items provided by other sections of work are properly sized and located

C. Prior to placement of grout, the wall section layup shall have been completed, the reinforcing steel and embedded items positioned and secured in place, the cells and/or courses in which grout is to be placed shall be free from all debris and rubbish, mortar projections, mortar droppings, etc., and the entire wall section inspected and accepted.

D. Beginning of installation shall mean acceptance of existing conditions.

3.2 FIELD PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other sections.

B. Furnish temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent support.

C. Concrete-masonry and masonry-masonry interfaces shall be roughened and free from mortar, dirt, mud, dust, oil, grease, wax, ice or snow, laitance, and any foreign matter or coating that adversely affects the bonding capacity of the mortar or grout.

D. Concrete surfaces to be mortared or grouted against at construction joints shall be sandblasted to a roughened surface with 1/16 inch amplitude.

E. Take necessary precautions against mortar dropping into grout spaces. Inadvertent mortar droppings shall be cleaned out of cells to be filled with grout.

F. At the time of grout placement, reinforcing steel, joint reinforcing, and wall ties shall be free from dirt, mud, grease, oil, ice or snow, kinks, loose or nonadherent rust and loose mill scale, and any foreign matter or nonmetallic coating that adversely affects the bonding capacity of the reinforcement and ties with the grout.

G. Reinforcing steel extending through construction joints shall be cleaned of grout and/or concrete and other contaminants prior to placement of subsequent grout.

H. Cells to be grouted shall not be wetted prior to grout placement.

I. Take suitable precautions against visible mortar and grout stains at exposed surfaces.

J. Provide an operable backup vibrator on site prior to grout placement.

3.3 MASONRY PLACEMENT

A. Masonry shall be laid up plumb, true to line, and with level courses within the allowable tolerances as defined in ACI 530.1.

B. Proper masonry units shall be used for bond beams, control joints, lintels, doors, etc., with a minimum of cutting. Where cutting of masonry units is necessary, it shall be by saw cutting and neat and accurate to the shape required.

C. Masonry units at the time of placement shall be sound, dry, clean, and free from cracks and other defects that would affect the proper placement of the unit or the strength/performance of the structure. Wet masonry units shall not be placed.

D. Wetting of the units prior to, during, or after placement shall be subject to prior review by CEC except as allowed for hot weather masonry construction.

E. Coursing of Concrete Unit Masonry, and Decorative Concrete Unit Masonry.
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints:Flush.

F. Placing and Bonding:
1. Lay solid masonry units in full bed of mortar, with full head joints.
2. Lay hollow masonry units with face shell bedding on head and bed joints.
3. Buttering corners of joints or excessive furrowing of mortar joints are not permitted.
4. Remove excess mortar as work progresses.
5. Interlock intersections and external corners.
6. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
7. Perform job site cutting of masonry units with proper tools to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
8. Cut mortar joints flush where cavity insulation vapor retarder adhesive is appliedorbitumen dampproofing is applied.
9. Isolate masonry from vertical structural framing members with movement joint
10. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler as indicated on Drawings.

G. Mortar shall be mechanically mixed in a mortar mixer in quantities only as required for immediate use for a minimum of 5 minutes but not more than 10 minutes after all the materials have been placed in the mixer and there is a uniform distribution ofmaterials. Hand mixing shall not be permitted.

H. Mortar at the time of masonry placement shall be in a plastic consistency necessary to provide proper bond. Mortar shall be retempered with water as required to maintain the proper consistency.

I. Retempering color mortar is not permitted.

J. Mortar shall be placed within 2-1/2 hours after initial mixing; mortar that has not retempered for 1 hour, has taken its initial set, has been contaminated by foreign materials, or has fallen on the ground or scaffolding shall not be placed.

K. Mortar joints shall be tooled, flush straight, and uniform in thickness, 3/8 inch thick, with full mortar coverage on the face shells, full mortar coverage on the webs at foundations and surrounding cells to be filled with grout, and head joint depth each face equal to the masonry unit face shell thickness minimum. Deep or excessive furrowing of mortar joints and buttering corners of joints shall not be permitted.

L. Exterior and exposed mortar joints shall be tooled with a round bar to a slightly concave shape. Interior mortar joints not exposed shall be struck off flush.

M. Mortar joints shall be tooled with a round bar to a slightly concave shape, refilled flush, and sacked.

N. Mortar joints not tight at the time of tooling shall be raked out, pointed using fresh mortar, and then retooled.

O. Mortar projections in cells to be filled with grout and at control joints shall be removed.

P. Masonry units shall be placed with sufficient pressure to provide proper bond at all joints.

Q. Masonry units displaced after being initially placed shall be removed from the wall, cleaned, and replaced using fresh mortar.

R. Weeps and Vents: Furnish weeps and vents in outer wythe at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

S. Cavity Wall: Do not permit mortar to drop or accumulate into cavity air space or to plug weeps. Build inner wythe ahead of outer wythe to receive cavity insulation and air/vapor retarder adhesive.
   1. Install cavity drain material continuously at bottom of each cavity above through wall flashing.

T. The tops of cells not to be filled with grout under horizontal bond beams shall be covered with expanded metal lath to contain the grout within the beam section unless solid- bottom bond beam units with vertical cell breakouts are used. The use of paper or felt covers shall not be permitted.

U. Vertical barriers of expanded metal lath shall be provided in bond beams at 30 feet on center maximum to control the horizontal flow of grout. Stagger barriers in adjacent bond beams 48 inches minimum. The use of paper, felt, or wood barriers shall not be permitted.

V. Step back unfinished work for placing subsequent work. The use of toothing shall be subject to prior review by CEC.

W. Masonry accessories shall be located and installed so as to conform accurately to the Drawings within the allowable tolerances.

X. Install anchor bolts, anchors, control joint filler, and other accessories to be built into the masonry as the wall is laid up and prior to grout placement.

Y. The position of pipes and conduit encased in or passing through concrete unit masonry shall be subject to prior review by CEC.

Z. Pipes and conduit passing through walls shall pass through sleeved holes sized 1 inch in diameter larger than the outside diameter of the pipe or conduit or as detailed on the Drawings in accordance with UL designation for the rating of the wall. Wall sleeves shall extend full thickness of the wall.

AA. Anchor bolts and diaphragm anchors shall be installed in fully grouted bond beams.

BB. Column anchors shall be installed in pairs at 24 inches on center in fully grouted vertical cells.

3.4 REINFORCEMENT INSTALLATION

A. Reinforcing steel shall be located and placed to conform accurately with the Drawings within the allowable tolerances as defined in ACI 530.1.

B. Vertical reinforcing steel for high-lift grouting shall be placed after completion of the wall section and prior to grouting or after the wall has been laid up to the bar positioner at or immediately above midheight of the wall with the remaining wall laid up using open- end block at vertical reinforcing steel.

C. Vertical reinforcing steel for low-lift grouting shall be placed after completion of the wall section and prior to grouting or prior to lay-up of the wall with the wall laid up using open-end block at vertical reinforcing steel.

D. Horizontal reinforcing steel and joint reinforcing shall be placed as the wall is laid up.

E. Reinforcing steel shall be located and placed with the cover as defined in ACI 530.1, unless detailed otherwise on the Drawings.

F. The clear distance between parallel horizontal bars shall not be less than one bar diameter nor 1 inch, whichever is greater.

G. The clear distance between parallel vertical bars shall not be less than one-and-one-half bar diameters nor 1-1/2 inches, whichever is greater.

H. Clear distance limitations shall also apply to adjacent splices of bars.

I. Provide corner bars of the same size and spacing as the horizontal reinforcing steel at all wall corners and intersections unless detailed otherwise on the Drawings. Length each side shall be the lap length plus the wall thickness.

J. Provide prefabricated joint reinforcing corner and tee sections at all wall corners and intersections respectively unless detailed otherwise on the Drawings.

K. Alternate corner bars at wall intersections and tie hooks 180 degrees.

L. Reinforcing steel splices shall be lap type unless detailed otherwise on the Drawings. Splices not specified in these Specifications or shown on the Drawings shall be subject to prior review by CEC.

M. Continuous horizontal reinforcing steel shall be installed in the longest possible lengths with the following minimum lap splices unless detailed otherwise on the Drawings:

Bar Size	**Lap Length**
No. 4	24 inches
No. 5	30 inches
No. 6	36 inches

N. Joint reinforcing shall be installed in the longest possible lengths with 6-inch minimum lap splices.

O. Reinforcing steel shall not pass through control joints.

P. The maximum allowable bar movement in order to avoid interference with other reinforcing steel or embedded items shall be one bar diameter. Bar movement beyond the allowable one-bar diameter shall be subject to prior review by CEC.

Q. Reinforcing steel shall be adequately supported and firmly held in place to prevent displacement and maintain proper spacing and distance from face shells and cross webs before and during grout placement by means of adequate bar positioners.

R. Reinforcing steel shall be positioned by use of bar positioners at top and bottom vertically, at each end horizontally, and at 4 feet on center maximum in both directions.

S. Reinforcing steel lap splices shall be securely tied to prevent displacement of splices before and during grout placement.

T. Miscellaneous openings that interrupt reinforcing steel shall have an equivalent area of reinforcing steel placed around the opening and extended on each side of the opening the lap length unless detailed otherwise on the Drawings.

U. Miscellaneous openings that interrupt joint reinforcing shall have joint reinforcing in the first two bed joints above and below the opening with the joint reinforcing in the second bed joint extended on each side of the opening 2 feet minimum.

V. Miscellaneous openings not shown on the Drawings shall be subject to prior review by CEC.

W. Field bending of reinforcing steel not shown on the Drawings shall be subject to prior review by CEC.

X. Joint Reinforcement And Anchorage – Single Wythe Masonry:
1. Install horizontal joint reinforcement 16 inches ([400] on center.
2. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 30 inches each side of opening.
3. Place joint reinforcement continuous in first joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches ([150] .
5. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

Y. Joint Reinforcement And Anchorage – Masonry Veneer:
1. Install horizontal joint reinforcement 16 inches on center.
2. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
3. Place joint reinforcement continuous in first joint below top of walls.
4. Lap joint reinforcement ends minimum 6 inches.

Z. Masonry Flashings:
1. Extend flashings horizontally through outer wythe at foundation walls,above ledge or shelf angles and lintels,at bottom of walls, and turn down on outside face to form drip.
2. Turn flashing up minimum 8 inches and bed into mortar joint of masonry seal to sheathing over steel studframed backing.
3. Lap end joints minimum 6 inches and seal watertight.
4. Turn flashing, fold, and seal at corners, bends, and interruptions.

AA. Lintels:
1. Install loose steel lintels over openings as shown on the Drawings.
2. Install reinforced unit masonry lintels over openings as shown on the Drawings.
3. Openings Up To 48 inches Wide: Place two, No. 4 reinforcing bars 1 inch from bottom web.
4. Openings From 48 inches up to 88 inches Wide: Place two, No. 4 reinforcing bars 1 inch from bottom web and two, number 4 reinforcing bars 1 inch from top.
5. Openings Over 88 inches: Reinforce openings as indicated on Drawings.
6. Do not splice reinforcing bars.
7. Support and secure reinforcing bars from displacement.
8. Place and consolidate grout fill without displacing reinforcing.
9. Allow masonry lintels to attain specified strength before removing temporary supports.
10. Maintain minimum 30 inch bearing on each side of openings.

BB. Install precast concrete units by skilled workers experienced in installation of type ofunits and applications required for work.

1. Place setting buttons of adequate size, in sufficient quantity, and same thickness

as mortar joint, to prevent mortar from squeezing out, and to maintain uniform joint widths. Hold buttons at least one joint-width back from face of units.

3.5 GROUT PLACEMENT

A. Cells/courses containing reinforcing steel, anchor bolts, and other embedments shall be fully grouted. Walls shall be grouted as shown on the Drawings.

B. Vertical cells to be high-lift grouted shall have a 3-inch by 4-inch minimum cleanout opening at the bottom course. Cleanout openings shall be made prior to placing the unit and sealed after inspection and prior to grouting.

C. Vertical cells to be filled with grout shall have the following minimum unobstructed vertical alignments:

Block Size	Minimum Core Dimensions
8 inches	3 by 4 inches
12 inches	3 by 6 inches

D. Each batch of grout shall be mixed in a truck mixer at time of charging for not less than 70 revolutions of the drum at mixing speed after all materials have been charged. Prior to discharging at the site, each batch shall be rotated not less than ten revolutions of the drum at mixing speed.

E. Grout shall be conveyed and placed at a regular rate as close as possible to final position with the aid of proper vibration equipment and procedures and in such a manner as to prevent segregation and/or loss of materials.

F. Grout that has been contaminated by foreign materials or has fallen on the ground or scaffolding shall not be placed.

G. The use of mortar as grout shall not be permitted.

H. Grout placement shall be by either the high-lift or low-lift method.

I. High-Lift Grout Placement Requirements:
1. Masonry shall be laid up full height between floors or between floor and roof and grouted in a continuous operation.
2. Grout shall be placed in 5-foot maximum lifts with no less than 30 minutes or more than 1 hour elapsing between lifts.
3. Masonry beams over openings shall be grouted in a continuous operation.
4. Grout shall be stopped 1-1/2 inches below top of units at construction joints except 3/4 inch below bond beam blockouts if at intermediate bond beams.

J. Low-Lift Grout Placement Requirements:
1. Masonry shall be laid up and grout shall be placed in 5-foot maximum lifts.
2. Masonry beams over openings shall be grouted in a continuous operation.
3. The full height of a wall section shall be grouted in a continuous operation.
4. Grout shall be stopped 1-1/2 inches below top of units at construction joints, except 3/4 inch below bond beam blockouts if at intermediate bond beams.

K. Grout shall be placed and consolidated with the aid of proper vibration equipment and procedures. Vibration shall be of sufficient duration and intensity to cause thorough compaction and settlement of grout into place and around all reinforcing steel and embedded items, but not sufficient to cause segregation.

L. Avoid vibrating or displacing the reinforcing steel with the vibrator.

M. Control and Expansion Joints:
1. Install control and expansion joints at the following maximum spacings, unless otherwise indicated on Drawings:
   a. Exterior Walls: 20 feet (6,000 mm) on center and within 24 inches (600 mm) on one side of each interior and exterior corner.
   b. Interior Walls: 30 feet (9,000 mm) on center.
   c. At changes in wall height.
2. Do not continue horizontal joint reinforcement through control and expansion joints.
3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
4. Size control joint in accordance with Section 07 90 00 – Joint Protection, for sealant performance.
5. Form expansion joint by omitting mortar and cutting unit to form open space.

N. Built-In Work:
1. As work progresses, install built-in metal door frames, fabricated metal frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Do not build in materials subject to deterioration.

O. Cutting And Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, rounds and Coordinate with other sections of work to provide correct size, shape, and location.
2. Obtain CEC's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.6 COLD WEATHER MASONRY CONSTRUCTION

A. When the ambient temperature is below 40 degrees F and above 32 degrees F, the mortar water shall be heated for a mortar temperature of 60 to 80 degrees F.

B. When the ambient temperature is below 32 degrees F and above 20 degrees F, the mortar water and sand shall be heated for a mortar temperature of 60 to 80 degrees F.

C. When the ambient temperature is below 20 degrees F, the mortar water and sand shall be heated for a mortar temperature of 60 to 80 degrees F, and the masonry units shall be heated to 20 degrees F minimum.

D. Masonry units and mortar sand that are wet and frozen shall be thawed, and masonry units colder than 20 degrees F shall be heated prior to placement. Wet or frozen masonry units shall not be placed.

E. Masonry construction that is frozen and cannot be properly thawed or is damaged due to freezing or thawing shall be removed and replaced with new materials.

3.7 HOT WEATHER MASONRY CONSTRUCTION

A. When the ambient temperature is above 100 degrees F or above 90 degrees F with a wind, mortar bedding surfaces shall be lightly wetted and mortar beds shall not be laid out ahead of placing masonry units.

3.8 FIELD QUALITY CONTROL

A. Reinforcing steel and masonry accessories shall be inspected after they have been placed or installed and prior to the placement of grout.

B. Cells to be grouted shall be inspected prior to placement of grout.

C. Grout placement shall be continuously inspected.

D. Special inspection shall be as indicated on the Drawings per the International Building Code.

E. Sampling of mortar and making and curing of mortar cylinders for compressive strength tests shall be in accordance with ACI 530.1.

F. One sample of mortar for compressive strength tests shall be taken for every 1,000 square feet or fraction thereof of wall laid up each day.

G. Four standard 2-inch-diameter by 4-inch cylinders shall be made at each sampling.

H. Compressive strength tests shall be made at 7 days using one cylinder and at 28 days using two cylinders each time. The fourth cylinder shall be tested at 56 days only if the 28-day tests are below the specified strength.

I. Grout slump tests shall be made in accordance with ASTM C143.

J. Sampling of grout and making and curing of grout prisms for compressive strength tests shall be in accordance with ACI 530.1.

K. One sample of grout for compressive strength tests shall be taken for every 50 cubic yards or fraction thereof of grout placed each day.

L. Four 3-inch by 3-inch by 6-inch prisms shall be made at each sampling.

M. Compressive strength tests shall be made at 7 days using one prism and at 28 days using two prisms each time. The fourth prism shall be tested at 56 days only if the 28-day tests are below the specified strength.

N. Masonry shall be inspected after installation.

3.9 CLEANING

A. Clean mortar and grout stains from exposed masonry. Cleaned surfaces shall be equal to the original surface such that stains are not visible.

B. Remove excess mortar and mortar smears as work progresses.

C. Replace defective mortar. Match adjacent work.

D. Use non-metallic tools in cleaning operations

E. Clean soiled surfaces with cleaning solution.

F. Masonry Cleaners: Non-acidic, not harmful to masonry work or adjacent materials:
1. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned
   a. Available Products: Sure Klean; Custom Masonry Cleaner

G. Cleaning of Ground-Faced Units:
1. Clean the completed walls with PROSOCO Burnished Custom Masonry Cleaner (dilute 1 part to 3 parts clean water), strictly following the manufacturer's instructions – including thorough rinsing
2. Do not use acid or abrasives on the finished surfaces.
3. Do not power-wash.

3.10 INTERIOR FACE WATERPROOFING

A. Where noted on drawings, apply waterproofing to interior face of masonry in accordance with the manufacturer’s instructions.

3.11 PROTECTION

A. Tops of walls not enclosed shall be covered at the end of each day or shut down with a durable waterproof covering that extends down each side of the walls 4 feet minimum and is securely anchored.

B. Wall sections shall be protected from construction operations, mechanical disturbances, dampening, soiling, and the weather for a minimum of 7 days after completion.

C. Protect exposed external corners subject to damage.

D. Protect base of walls from mud and mortar splatter.

E. Construction loads shall not be allowed on the structure or portions thereof until the grout has attained 60 percent of its specified 28-day compressive strength (7 days minimum) as substantiated by field-cured prisms unless higher strengths are required for the intended loading.

F. Walls tied to floor or roof systems shall be braced and removal of bracing shall not be allowed until the floor or roof system is complete and of sufficient strength for the intended loading.

G. When the ambient temperature is below 32 degrees F and above 20 degrees F with wind velocities over 15 mph, wind breaks shall be provided.

H. When the ambient temperature is below 20 degrees F, protective enclosures shall be provided. Ambient temperature in protective enclosures shall be maintained above 40 degrees F.

I. Masonry construction shall be protected from freezing a minimum of 24 hours after lay-up of the walls.

J. When the ambient temperature is above 100 degrees F or above 90 degrees F with a wind, a very light fog spray not sufficient to penetrate the masonry shall be provided a minimum of 24 hours after lay-up of the walls.

END OF SECTION 042200

SECTION 051200 STRUCTURAL STEEL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Structural shapes.
2. Channels and angles.
3. Hollow structural sections.
4. Structural pipe.
5. Structural plates and bars.
6. Floor plates.
7. Fasteners, connectors, and anchors.

B. Related Sections:
1. Section 03 60 00 – Grout.
2. Section 09 90 00 – Painting and Coating.

1.2 REFERENCES

A. Abbreviations and Acronyms:
1. Authority having jurisdiction (AHJ).
2. American Institute of Steel Construction (AISC).
3. Association of Iron and Steel Engineers (AISE).
4. American National Standards Institute (ANSI).
5. American Society of Civil Engineers (ASCE).
6. American Society of Testing and Materials (ASTM).
7. American Welding Society (AWS).
8. Construction Management Association of America (CMAA).
9. Charpy V-notch (CVN).
10. Flux Core Arc Welding (FCAW).
11. Federal Emergency Management Agency (FEMA).
12. Green Seal (GC).
13. Gas Metal Arc Welding (GMAW).
14. International Building Code (IBC).
15. International Code Council (ICC).
16. Quenching and Self-tempering (QST).
17. Research Council on Structural Connections (RCSC).
18. Submerged Arc Welding (SAW).
19. Shielded Metal Arc Welding (SMAW).
20. Society for Protective Coatings (SSPC).
21. Volatile organic compounds (VOC).

B. Definitions:
1. American Institute of Steel Construction (AISC) Certifications:
a. Standard Steel Building Structures (STD).
b. Conventional Steel Building Structures (SBD).
c. Complex Steel Building Structures (CBD).
d. Simple Steel Bridges (SBR).
e. Major Steel Bridges (CBR).
f. Certified Steel Erector (CSE): Erection Contractors providing services necessary for erection of structures such as schools, shopping centers, light manufacturing plants, warehouses, low-rise beam and column structures, simple non-continuous bridges, and steel-framed buildings.
g. Advanced Certified Steel Erector (ACSE): Erection Contractors providing services necessary for erection of structures such as large public and institutional buildings, heavy manufacturing plants, bunkers, bins, major bridges, continuous girder bridges, railroad bridges, powerhouses, major industrial facilities, locks and dams, high-rise structures, arenas, and repair and rehabilitation of existing steel structures.

C. Reference Standards:

1. AISC 201, Certification Program for Structural Steel Fabricators.
2. AISC 326, Detailing for Steel Construction.
3. AISC 303, Code of Standard Practice for Steel Buildings and Bridges.
4. AISC 325, Steel Construction Manual.
5. AISC 360, Specification for Structural Steel Buildings.
6. American National Standards Institute (ANSI) / AISC 341, Seismic Provisions for Structural Steel Buildings.
7. American Society of Testing and Materials (ASTM) A6/A6M, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
8. ASTM A36/A36M, Standard Specification for Carbon Structural Steel.
9. ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated, Welded and Seamless.
10. ASTM A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-finished.
11. ASTM A123/A123M, Standard Specification for Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.
12. ASTM A153/A153M, Standard Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.
13. ASTM A193/A193M, Standard Specification for Alloy-steel and Stainless Steel Bolting Materials for High-temperature Service or High Pressure Service and Other Special Purpose Applications.
14. ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
15. ASTM A325/A325M, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105ksi Minimum Tensile Strength.

16. ASTM A354, Standard Specification for Quenched and Tempered Alloy Steel Bolts, Studs, and Other Externally Threaded Fasteners.
17. ASTM A384/A384M, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
18. ASTM A385/A385M, Standard Practice for Providing High Quality Zinc Coatings (Hot-Dip).
19. ASTM A449, Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
20. ASTM A490/A490M, Standard Specification for Structural Bolts, Alloy-steel, Heat Treated, 150ksi Minimum Tensile Strength.
21. ASTM A500/A500M, Standard Specification for Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
22. ASTM A501 - Standard Specification for Hot-formed Welded and Seamless Carbon Steel Structural Tubing.
23. ASTM A514/A514M, Standard Specification for High-yield-Strength, Quenched and Tempered Alloy-steel Plate, Suitable for Welding.
24. ASTM A529/A529M, Standard Specification for High-strength Carbon-manganese Steel of Structural Quality.
25. ASTM A563/A563M, Standard Specification for Carbon and Alloy-steel Nuts.
26. ASTM A572/A572M, Standard Specification for High-strength Low-alloy Columbium-vanadium Structural Steel.
27. ASTM A618/A618M, Standard Specification for Hot-formed Welded and Seamless High-strength Low-alloy Structural Tubing.
28. ASTM A786/A786M, Standard Specification for Hot-rolled Carbon, Low-alloy, High-strength Low-alloy, and Alloy-steel Floor Plates.
29. ASTM A992/A992M, Standard Specification for Structural Steel Shapes.
30. ASTM 1085, Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
31. ASTM B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
32. ASTM E94, Standard Guide for Radiographic Examination.
33. ASTM E164, Standard Practice for Ultrasonic Contact Examination of Weldments.
34. ASTM E165, Standard Test Method for Liquid Penetrant Examination for General Industry.
35. ASTM E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
36. ASTM E709, Standard Guide for Magnetic Particle Examination.
37. ASTM F436/F436M, Standard Specification for Hardened Steel Washers.
38. ASTM F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
39. ASTM F959, Standard Specification for Compressible-washer-type Direct Tension Indicators for Use with Structural Fasteners.
40. ASTM F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105ksi Yield Strength.
41. ASTM F1852, Standard Specification for Twist Off Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105ksi Minimum Tensile Strength.

42. ASTM F2329, Standard Specification for Zinc-coating, Hot-dip, Requirements for Application to Carbon and Alloy-steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners.
43. American Welding Society (AWS) A2.4, Standard Symbols for Welding, Brazing, and Nondestructive Examination.
44. AWS D1.1, Structural Welding Code – Steel.
45. International Code Council (ICC) International Building Code (IBC).
46. Research Council on Structural Connections (RCSC), Specification for Structural Joints Using High Strength Bolts.
47. Society for Protective Coatings (SSPC), Steel Structures Painting Manual.
48. SSPC Paint 15, Steel Joist Shop Primer/Metal Building Primer.
49. SSPC Paint 20, Zinc-rich Coating, Type I - Inorganic and Type II - Organic.
50. SSPC SP 3, Power Tool Cleaning.
51. SSPC SP 6, Commercial Blast Cleaning.
52. SSPC SP 10, Near-White Blast Cleaning.

1.3 SUBMITTALS

A. Refer to the Submittal Schedule at the end of Part 3 for a list of submittal requirements for this Section.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with the following:

1. AISC Code of Standard Practice for Steel Buildings and Bridges.
2. AISC Seismic Provisions for Structural Steel Buildings.
3. AISC Specification for Structural Steel Buildings.
4. RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts.

1.5 QUALIFICATIONS

A. Fabricator: Company specializing in performing Work of this section with minimum five years' documented experience with the following current AISC Certification:
1. Standard Steel Building Structures (STD).

B. Erector: Company specializing in performing Work of this section with minimum five years' documented experience with the following current AISC Certification:
1. Certified Steel Erector (CSE).

C. Shop Painter: Company specializing in performing Work of this section with minimum five years' documented experience with the following current AISC Certification:
1. SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators".

D. Welders, Welding Inspectors, and Welding Procedures: AWS D1.1 qualified within previous 12 months.

E. Testing and inspection agencies to be in conformance with ASTM E329.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel and fabricated accessories to the site prime painted or special painted, except as otherwise specified, and marked with a piece number and clearly identified according to grade.

B. 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 erosion and deterioration.
   1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
   2. 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.

1.7 COORDINATION

A. Furnish 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.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural W-Shapes: ASTM A992/A992M or ASTM A572/A572M; Grade 50.

B. Structural S-Shapes: ASTM A36/A36M.

C. Structural T-Shapes: Cut from structural W-shapes.

D. Channels and Angles: ASTM A36/A36M or ASTM A572/A572M; Grade 50.

E. Square and Rectangular Hollow Structural Sections: ASTM A500, Grade B.

F. Structural Plates and Bars: ASTM A36/A36M or ASTM A572/A572M; Grade 50.

G. Floor Plates: ASTM A786/A786M; diamond raised pattern.

2.2 FASTENERS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts: ASTM A325; Type 1 or ASTM A490; Type 1.
   1. Finish: Hot-dip galvanized.

B. Nuts: ASTM A563 heavy hex type.
   1. Finish: Hot-dip galvanized.

C. Washers: ASTM F436; Type 1, beveled. Furnish clipped washers where space limitations require. Provide ASTM F844 washers or plate washers at oversized and slotted holes in base plates.
1. Finish: Hot-dip galvanized.

D. Direct Tension Indicators: ASTM F959; Type 490.
1. Finish: Mechanically galvanized.

E. Tension Control Assemblies: ASTM F1852; Type 1, heavy hexhead, twist-off type; complete with washers and heavy hex nuts.
1. Finish: Finish: Mechanically galvanized.

F. Threaded Rods: ASTM A36/A36M unless otherwise shown on Drawings.
1. Finish: Hot-dip galvanized or mechanically galvanized.

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2.3 CONNECTIONS

A. General: Weld or high-strength bolt all shop connections. Design connections to develop reactions and stresses shown on Drawings. The design of the connections to include any stiffeners, web doubler plates, etc., associated with the connection. Where reaction or stress is not noted, design connections to develop a capacity in accordance with Paragraph D below.

B. Notwithstanding any provision to the contrary in AISC “Code of Standard Practice for Steel Buildings and Bridges” or in this Section, all connections designed by fabricator are the fabricator’s responsibility and review of shop drawings do not relieve fabricator of this responsibility. A Professional Engineer registered in the State where the project is located to design, or directly supervise the design of, the member connections and affix seal to the connection calculations. In addition, the connection design engineer to review the shop drawings for conformance with the connection design requirements.

C. Design connections to provide suitable access for field connections. Provide not less than two bolts per connection. Remove burrs, pits, and other defects from contact surfaces of steel surfaces where members are jointed.

D. Beam connections to be standard framed connections. Unless greater reactions are indicated on the Drawings, connections to develop at least 60 percent of the total Uniform Load Capacity tabulated in the Tables of the Manual for the given shape and span of the beam in question. In no case, however, shall the length of the framed connections be less than 1/2 “T” dimension of the beam web.

E. High-Strength Bolted Connections:
1. Design: Unless noted otherwise, design high-strength bolted connections as bearing type with threads in shear planes. Include in the design of connections consideration for web tear-out (block shear).

2. Tension: Tighten each bolt to provide, when all fasteners in a joint are tight, at least minimum tension listed in Table 8.1 of the "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".

F. Provide filler plates and connections for double angle members in accordance with AISC Specifications. Provide filler plates at equal spaces not exceeding 5'-0".

G. Gusset plate thicknesses not indicated on the Drawings to be 3/8-inch-thick, minimum.

H. Bracing connections to be designed and detailed so that all force components are delivered directly to the workline intersection of the members, unless approved by Engineer.

I. Connections for trusses, bottom chord bracing, sway frames, X-bracing, lacing, and similar type members to develop the force indicated on the Drawings or one-half the allowable tension force in the member, whichever is larger. If no force is indicated on the Drawings, the connections to develop one-half the allowable tension force in the member, but not less than 22 kips. Provide a minimum of two bolts per connection.

J. Sign convention for axial forces in members indicated on Drawings are as follows:
1. (+) indicates tension in member.
2. (-) indicates compression in member.

K. Field splices of trusses to be approved by Engineer.

L. Unequal angles to have the long legs back-to-back, in the plane of the truss, unless Drawings indicate otherwise.

M. Welded Connections: Welds to be designed using the values given in Table J2.5 of AISC 360-10.

2.4 WELDING MATERIALS

A. Welding Filler Metal: AWS A5.1 or A5.5 E70XX for SMAW welding process, AWS A5.18 or A5.28 ER70S-X for GMAW welding process, and AWS A5.17 or A5.23 F7X-EXXX for SAW welding process. The FCAW welding process with E7XT-X electrodes to not be used without prior approval by Engineer. Electrodes to be low-hydrogen type or equivalent. All weld filler metal used in the seismic force resisting system as noted on the drawings to satisfy the following additional requirements:
1. CVN toughness of 20 foot-pounds at 0 degrees F when tested in accordance with AWS A5.
2. CVN toughness of 40 foot-pounds at 70 degrees F when tested in accordance with Part 1, Appendix A of FEMA 353, "Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications".
3. Yield strength of 58 ksi minimum when tested per AWS A5 for E70 electrodes and also when tested in accordance with Part 1, Appendix A of FEMA 353, "Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications".

4. Tensile strength of 70 ksi minimum when tested per AWS A5 for E70 electrodes and also when tested in accordance with Part 1, Appendix A of FEMA 353, "Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications".
5. Elongation of 22 percent minimum when tested per AWS A5 for E70 electrodes and also when tested in accordance with Part 1, Appendix A of FEMA 353, "Recommended Specifications and Quality Assurance Guidelines for Steel Moment-Frame Construction for Seismic Applications".
6. Hydrogen level meeting requirements for H16 as tested using the mercury or gas chromatograph method as specified in AWS A4.3.

2.5 ACCESSORIES

A. Standard Prime Paint for Steel: as specified in Section 09 90 00 – Painting and Coating.

B. Touch-Up Primer: Match shop primer.

C. Touch-Up Primer for Galvanized Surfaces: SSPC Paint 20 Type II Organic.

2.6 FABRICATION

A. Structural steel to be completely shop fabricated, except as otherwise shown on the Drawings.

B. Fabricate steel to conform with AISC's "Steel Construction Manual" and "Code of Standard Practice for Steel Buildings and Bridges", subject to modifications outlined in this section, design drawings, and applicable building codes and ordinances.

C. Develop required camber for members as indicated on the Drawings.

D. Identify high-strength structural steel according to ASTM A6/ A6M and maintain markings until structural steel has been erected.

E. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible. Plane thermally cut edges to be welded to comply with the requirements in AWS D1.1.

F. Sheared and flame cut edges to be true to line and free from rough corners and projections.

G. Fillet re-entrant cuts/corners to a radius of not less than 1/2 inch.

H. Punched, sub-punch and ream, or drill holes in accordance with AISC Specifications for Structural Steel Buildings. Remove burrs that would prohibit solid seating of the connected parts. Holes to not be made by flame cutting.

I. Standard holes to be 1/16 inch larger than the nominal bolt diameter, except maximum size holes for cast-in-place anchor bolts that to be oversized in accordance with AISC.

J. Oversize or slotted holes not shown on the Drawings to be subject to prior review by the Engineer.

K. Bent plate to be in accordance with AISC “Minimum Radius for Cold Bending”.

L. Saw cut or mill column ends bearing upon base and cap plates and beam ends with end plates to true surfaces and correct bevels.

M. Mill column bearing surfaces on plates 2 inches or more in thickness to true surfaces except at surfaces to be grouted against.

N. Column caps and base plates and beam end plates to have full contact when assembled.

O. Welding to conform to AWS D1.1 and to be performed in accordance with the appropriate weld procedure specification for the joint.

P. Welding preheat to conform to the more restrictive of AWS D1.1 or the electrode manufacturer’s recommendations. For ASTM A6 Group 4 and Group 5 shapes and built-up members made up of plates more than 2 inches thick, a preheat equal to or greater than 350 degrees F to be used when making groove weld splices.

Q. For all complete joint penetration and partial joint penetration groove welds subjected to ultrasonic testing, place a visible mark, “for UT”, accurately on the steel a distance no greater than 4 inches away from the edge preparation.

R. Welding to be done in a sequence that minimizes distortion and shrinkage.

S. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

T. Weld headed concrete anchors in accordance with AWS C5.4 and AWS D1.1, or field welded in accordance with AWS.

U. Fabrication (holes, notches, etc.) not required by nor shown on the Drawings to be subject to prior review by Engineer.

V. Weld access holes to comply with AWS D1.1, Section 2.6.6 and the following:
1. Provide weld access holes of adequate size to insure access for welding and inspection.
2. Weld access holes to be a minimum length from the toe of the weld preparation to the end of the hole of 1.5 inches and be a minimum height of 1 inch.
3. The radii of the weld access hole to be smooth and free of notches.
4. Weld access holes in ASTM A6 Group 4 and Group 5 shapes and welded built- up shapes with material thickness greater than 2 inches to be thermal cut to be preheated to a temperature of not less than 150 degrees F prior to thermal cutting.

W. Weld tabs to comply with AWS D1.1, Section 5.31, and the following:
1. Weld tabs to extend beyond the edge of the joint a distance equal to a minimum of the part thickness, but not less than 1 inch.
2. Weld tabs at splices of heavy sections to be removed and ground smooth to a finish of 500 micro-inches or better. Gouges or notches to satisfy the requirement of AWS D1.1.

X. Backing bars to comply with AWS D1.1, Section 5.10 and the following:
1. All tack welds attaching backing bars to the steel to be made within the joint.
2. Backing bars at splices of heavy sections to be removed. Where fusible backing is used, the root pass area to be back-gouged and back-welded until flush or with slight reinforcement, then ground smooth to a surface roughness not to exceed 500 micro-inches. Gouges and notches to satisfy the requirements of AWS D1.1.
3. Backing bars to be removed where noted on the Drawings.

Y. When notch-toughness is specified, the process consumables for all weld metal, tack welds, root pass and subsequent passes, deposited in a joint to be compatible to assure notch-tough composite weld metal.

Z. Fillet welds and groove welds exposed to view to have as-welded surfaces that are reasonably smooth and uniform.

2.7 FINISH

A. Prepare structural component surfaces in accordance with manufacturer's specifications and Section 09 90 00 – Painting and Coating.

B. Prepare faying surfaces at high-strength slip-critical bolted connections as for Class A or better slip-critical joints, unless noted otherwise on the Drawings, and protect against overspray by use of masking. Remove inadvertent overspray from the faying surfaces at high-strength slip-critical bolted connections.

C. Protect surfaces to be welded from painting by use of masking. Remove inadvertent overspray on surfaces to be welded by wire brushing.

D. Shop prime structural steel members. Do not prime surfaces that will be field welded, in contact with concrete, grouted against, or high-strength slip-critical bolted (A325SC) connections.

E. Paint structural steel, where shown on the Drawings to be epoxy painted, per Section 09 90 00 – Painting and Coating.

2.8 GALVANIZING

A. Galvanize and fabricate steel in accordance with ASTM A123, A384, and A385. Galvanize after fabrication, unless not recommended by ASTM standards specified. Thoroughly clean weld slag, weld splatter, oil, grease, dirt, and other foreign matter from surfaces to be galvanized.

B. Galvanized bolts, nuts, and washers in accordance with ASTM A153. Conform to additional requirements in ASTM A325 for high-strength bolts.

C. Seal weld all overlapping or contacting surfaces.

D. Remove all weld splatter, weld slag, and burrs and provide surface suitable for galvanizing.

E. Remove all entrapped ash, flux or particles, rust staining, and zinc runs on member contacting surfaces.

F. Use galvanized bolts, washers and nuts unless noted otherwise on the Drawings or in specifications.

2.9 SOURCE QUALITY CONTROL AND TESTS

A. Shop test bolted and welded connections as specified for field quality control tests.

B. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
1. Specified shop tests are not required for Work performed by approved fabricator.

C. Correct all deficiencies in material or workmanship. Where repairs alter the members as dimensioned and detailed on the shop drawings by notching or removing base material, submit such repairs for review by the Engineer.

D. Inspect installation of high-strength slip-critical bolts per special inspection requirements of the ICC International Building Code.

E. Test three bolts of each size, length, type, grade, and lot of high-strength slip-critical bolts using the actual joint configuration (faying plies, nuts, washers, etc.) and installation tools and methods to be used for production work. Each bolt to develop a tension 5 percent in excess of the RCSC required pretension to be accepted.

F. Inspect a minimum of 10 percent of high-strength bolts in slip-critical connections using load indicator washers, but not less than two bolts in each connection, after tensioning. Inspect load indicator washers after tensioning using a metal feeler gauge.

G. Inspect tension control bolts periodically to confirm bolt-tensioning sequence. Inspect tension control bolts after tensioning to confirm that bolt spline drive ends have been sheared off.

H. Inspection of welding to be in accordance with AWS D1.1and special inspection requirements of ICC International Building Code with all welds visually inspected. Approval of fabricator's shop in order to waive special inspection by an independent inspection agency to be subject to prior review by Owner.

I. Acceptance of welding inspection results to be in accordance with AWS D1.1.

J. Inspection of headed concrete anchor welding to be in accordance with AWS D1.1 and special inspection requirements of ICC International Building Code.

K. Test a minimum of 10 percent of headed concrete anchors in accordance with AWS D1.1.

L. Test a minimum of 100 percent of indicated welds where noted on the Drawings and 100 percent of full penetration welds for members with no connection redundancy such as cantilevered beam connections. In addition test the following:
1. Splices in truss chords.
2. Splices in columns.
3. Splices in members brought about by misorder or misfabrication.
4. Field welding (at locations indicated on drawings).

M. Acceptance of welding test results to be in accordance with AWS D1.1.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify bearing surfaces are at correct elevation.

B. Verify anchors rods are set in correct locations and arrangements with correct exposure for steel attachment.

3.2 PREPARATION

A. At the time of connecting, bearing surfaces to be free from loose or non-adherent rust, loose mill scale, oil, grease, dirt, mud, and foreign matter, coating, or defect that adversely affects the connection.

B. At the time of connecting, faying surfaces at high-strength slip-critical bolted connections to be free from loose or nonadherent rust, loose mill scale, oil, grease, dirt, mud, and foreign matter, coating, or defect that adversely affects the connection.

C. Surface preparation for welding to be in accordance with AWS D1.1 except loose or nonadherent rust, loose mill scale, and paint to be removed by wire brushing. Paint need not be removed if weld procedure qualifications for welding through the paint material are submitted.

D. Clean and re-lubricate bolts, nuts, and washers that become dry or rusty before use. Re- lubricate F1872 fastener components following the manufacturer's written instructions, and retest after lubrication and prior to use to verify suitability for installation.

3.3 ERECTION

A. Make all connections in accordance with requirements specified in Part 2 of this Section. In addition, where erection requires performing fabrication work on site, this work to conform to applicable specifications for Fabrication in Part 2 of this Section.

B. Erect steel to conform with AISC's "Steel Construction Manual" and "Code of Standard Practice for Steel Buildings and Bridges", subject to modifications outlined in this section, design drawings, and applicable building codes and ordinances.

C. Allow for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.

D. Do not field cut or alter structural members without approval of Engineer.

E. Use high-strength bolts for all field connections. Install and tighten high-strength bolts in accordance with the RCSC Specifications for Structural Joints Using High Strength Bolts. Infill excess connection holes from fabrication errors or design changes with like bolts used in connection.

F. Field welding is permitted only if specifically indicated or approved by Engineer. Welding to be done in a sequence that minimizes distortion and shrinkage.

G. Where field welding is permitted, the steel to not be painted in the area of the field weld. The area to be welded to be free from paint a minimum of 4 inches on either side of the weld. Where connections require field welding due to misfabrication, the paint within 4 inches of the weld to be removed.

H. Electrodes preheat and welding processes to meet AWS prequalification requirements and the electrode manufacturer's written recommendations for specific applications.

I. Shear connector studs to be welded in accordance with AWS C5.4 and AWS D1.1.

J. Ream holes that must be enlarged to admit bolts. Do not enlarge holes by flame cutting.

K. Field correcting by flame cutting is not permitted without prior review by the Engineer.

L. Furnish and install filler and/or shim plates to provide alignment of members where required due to mill and/or fabrication tolerances and as indicated on Drawings.

M. Do not cut or alter any member of the seismic force resisting system to correct fabrication errors or for the work of other trades without prior approval of the Engineer. Submit detailed documentation outlining exact location, reasons for change, and details of proposed work. Perform work in accordance with the requirements of the Contract Documents.

N. After erection, touch up welds and abrasions to match shop finishes.

3.4 GROUT INSTALLATION

A. Grout under base plates in accordance with Section 03 60 00 – Grout.

B. Shim bearing plates and equipment supports to proper elevation; snug tighten anchor bolts.

C. Fill void under bearing surface with grout. Install and pack grout to remove air pockets.

D. Moist cure grout.

E. Remove forms after grout is set. Trim grout edges to from smooth surface, splayed 45 degrees.

F. Tighten anchor bolts after grout has cured for a minimum of 3 days.

3.5 TOLERANCES

A. General: Do not exceed tolerances permitted by AISC “Code of Standard Practice For Steel Buildings and Bridges” and “Quality Criteria and Inspection Standards”. Exercise care to ensure that individual member tolerances do not accumulate in completed structure.

B. Fabricate and erect steel such that the erected steel to not exceed the tolerances as given in Chapter 5.18 AISE Technical Report No. 13 dated 2003, “Guide for the Design and Construction of Mill Buildings”.

C. Tolerances: The more stringent of all above listed tolerances and on the Drawings to control.

D. Tolerance Submittals: Contractor to submit documentation including results of surveys that they have met the above stated tolerances. The documentation to be submitted at various stages of fabrication and erection as required by Owner.

3.6 FIELD QUALITY CONTROL

A. Inspect structural steel after erection to ensure conformance to the Drawings within the allowable tolerances permitted in the AISC Code of Standard Practice for Steel Buildings and Bridges.

B. Bolted Connections: Inspect in accordance with AISC specifications.
   1. Visually inspect all bolted connections.
   2. For Direct Tension Indicators, comply with requirements of ASTM F959. Verify that gaps are less than gaps specified in Table 2.

C. Inspect installation of high-strength slip-critical bolts per special inspection requirements.

D. Welding: Inspect welds in accordance with AWS D1.1.
   1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record work required and performed to correct deficiencies.
   2. Visually inspect all welds.
   3. Ultrasonic Inspection: ASTM E164; perform on all full penetration welds.
   4. Liquid Penetrant Inspection: ASTM E165.
   5. Magnetic Particle Inspection: ASTM E709.
   6. Radiographic Inspection: ASTM E94.

E. Inspection of welding to be in accordance with AWS D1.1 and special inspection requirements (with all welds visually inspected).

F. Acceptance of welding test results to be in accordance with AWS D1.1.

G. Correct defective bolted connections and welds.

3.7 REPAIR AND CLEANING

A. Repair welded, abraded, and scarred areas and connections on all painted and galvanized surfaces. Field paint all unpainted surfaces including nuts, bolts, washers, welds, and connection components.

B. Preparation and coating to be as follows:
   1. Painted Surfaces: Use same kind of paint and with minimum dry film thickness equal to that previously applied to steel unless manufacturer has different requirement.
   2. Galvanized Surfaces: Use galvanizing repair paint in accordance with manufacturer’s recommendations.

END OF SECTION 051200

SECTION 054000 - COLD-FORMED METAL 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. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Floor joist framing.
4. Roof rafter framing.
5. Ceiling joist framing.
6. Soffit framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
3. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

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. ClarkWestern Building Systems, Inc.
2. Dietrich Metal Framing; a Worthington Industries Company.
3. MarinoWARE.
4. Steel Network, Inc. (The).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft..
   b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 > of the wall height.
   c. Floor Joist Framing: Vertical deflection of 1/360 for live loads and l/240 for total loads of the span.
   d. Roof Rafter Framing: Vertical deflection of 1/240 of the horizontally projected span for live loads.
   e. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 3/4 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. 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.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G90 or equivalent.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

2.4 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, and as indicated on construction documents:

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges:

2.5 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges:

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.

11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-

resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As indicated.

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes shop fabricated metal items.

B. Related Sections:
1. Section 03 30 00 – Cast-In-Place Concrete: Execution requirements for embedded anchors and attachments for metal fabrications specified by this section in concrete.
2. Section 09 90 00 – Painting and Coating: Field-applied paint finish.

1.2 STANDARDS

A. American Iron and Steel Institute:
1. AISI Design of Cold-Formed Steel Structural Members.

B. American Welding Society:
1. AWS D1.1 – Structural Welding Code – Steel.
2. AWS D1.6 – Structural Welding Code – Stainless Steel.
3. AWS A2.4 – Standard Symbols for Welding, Brazing, and Nondestructive Examination.

C. Federal Specifications:
1. RR-G-1602D – Metal Grating other than Bar Type.

D. National Ornamental & Miscellaneous Metals Association:
1. NOMMA Guideline 1 – Joint Finishes.

1.3 SUBMITTALS

A. Refer to the Submittal Schedule at the end of Part 3 for a list of submittal requirements for this Section.

1.4 QUALITY ASSURANCE

A. Finish joints in accordance with NOMMA Guideline 1. Provide Finish 3 joints except as noted on the Drawings.

B. Welding procedures and qualifications as well as welders' and tackers' qualifications shall be in accordance with AWS D1.1.

C. Welding inspector's qualifications shall be in accordance with AWS D1.1.

D. Safety grating section properties shall be computed in accordance with AISI Specifications for the Design of Cold-Formed Steel Structural Members.

E. Safety grating slip resistance shall be in conformance with Federal Standard RR-G-1602D.

F. Testing/inspection agencies shall be in conformance with ASTM E329.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept metal fabrications on site in labeled shipments. Inspect for damage.

B. Miscellaneous metal fabrications shall be delivered to the site prime or special painted/coated, except as otherwise specified, and marked with a piece number.

C. Miscellaneous metal fabrications and fasteners at the site shall be stored off the ground and stored/handled in such a manner as to prevent soiling, corrosion, and/or damage.

1.6 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on shop drawings, or instructed by manufacturer.

PART 2 PRODUCTS

2.1 MATERIALS – METALS

A. Steel:
1. Steel Sections: ASTM A36/A36M or ASTM A992.
2. Steel Plate: ASTM A36/A36M.
3. Hollow Structural Sections: ASTM A500, Grade B.
4. Steel Pipe: ASTM A53/A53M, Grade B, Schedule 40.
5. Sheet Steel: ASTM A653/A653M, Grade 33 Structural Quality with galvanized coating.
6. Raised-Pattern (Checkered) Floor Plate: ASTM A786.
7. Bolts: ASTM A325; Type 1 Finish: Hot dipped galvanized.
8. Nuts: ASTM A563 heavy hex type. Finish: Hot dipped galvanized.
9. Washers: ASTM F436; Type 1, except ASTM F844 for washers and plate washers at oversized and slotted holes in base plates. Finish: Hot dip galvanized.
10. Welding Materials: AWS D1.1; type required for materials being welded.
11. Touch-Up Primer: Match shop primer.

B. Stainless Steel:
1. Bars and Shapes: ASTM A276; Type 304.
2. Tubing: ASTM A269; Type 304.
3. Pipe: ASTM A312/A312M, seamless; Type 304.
4. Plate, Sheet and Strip: ASTM A167; Type 304.

5. Bolts, Nuts, and Washers: ASTM A354.
6. Welding Materials: AWS D1.6; type required for materials being welded.

2.2 LEDGE AND SHELF ANGLES

A. Ledge and Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking, joists, and masonry; galvanized or prime paint, one coat, per Drawings.

2.3 DOOR FRAMES

A. Door Frames: Steel channel sections, size indicated on Drawings, with jamb anchors suitable for attachment to concrete or steel framing, minimum four anchors per jamb; prime paint, one coat.

2.4 BOLLARDS

A. Bollards: Steel pipe, concrete filled, crowned cap, 6 inches diameter, length as indicated on Drawings; paint safety yellow per Section 09 90 00.

B. Concrete Fill: 4,000 psi as specified in Section 03 30 00.

C. Base Connection: As indicated on Drawings.

2.5 WALL PROTECTION PLATES AND CORNER GUARDS

A. Wall Protection Plates: Stainless steel plate, 1/8 inch thick, countersunk fasteners, beveled exposed edges, size as indicated on Drawings.

B. Corner Guards: Stainless steel angle, 3 x 3 x 1/8 inch, countersunk fasteners, beveled exposed edges, size as indicated on Drawings.

2.6 MECHANICAL ANCHORS

A. Size and diameter indicated.

B. Do not install post-installed anchors until concrete has cured for 21 days unless ACI 318 or manufacturer's testing and documentation establish a shorter period.

C. Manufacturers:
1. Hilti, "Kwik Bolt TZ", or "HSL-3".
2. Simpson Strong-Tie, "Strong-Bolt 2" or "Strong-Bolt".

2.7 ADHESIVE ANCHORS

A. Size and diameter indicated.

B. Do not use Adhesive anchors in overhead, permanent tension, applications

without written approval by the Owner.

C. Manufacturers:
1. Hilti HAS threaded rods with HIT-RE 500 V3 Safe Set System using Hilti Hollow Drill Bit System for anchorage to concrete.

2. ASTM F1554, Grade 36, or ASTM A193, Grade B7; or stainless steel conforming to ASTM A193, Grade B6 or B8 using with Simpson Strong-Tie, “AT-XP” adhesive.

2.8 UNDERCUT ANCHORS

A. Size and diameter indicated.

B. Manufacturers:
1. Hilti, “HDA”.
2. Simpson Strong-Tie, “Torq-Cut”.

2.9 DROP-IN ANCHORS

A. Size and diameter indicated.

B. Manufacturers:
1. Hilti, “HDI Drop-In Anchor”.
2. Simpson Strong-Tie, “Drop-In”.

2.10 MANHOLE FRAMES AND LIDS

A. Provide heavy-duty frames with bolted cover and gasket seal.

B. Manufacturers:
1. East Jordan Iron Works, “MH 1046”.
2. McCoy Construction Castings, “401.03”.
3. Neenah Foundry Company, “No. 1757-G with Type C gasket lid”.

2.11 HIGHWAY TYPE GUARD RAILS

A. Supply units with all required anchoring devices, terminal sections, rail splices, and curved sections.

B. Galvanize rails and all accessories in accordance with ASTM A653, G210 Coating Designation.

C. Manufacturers:
1. Armco Drainage and Metal Products, Inc., “Flex-Beam Guardrail”, 10-gauge, high tensile steel.

2.12 STEEL BAR GRATING:

A. Bearing Bars:
   1. Size and coating shall be as shown on the Drawings.
   2. Spacing: 1-3/16 inches on center.
   3. Surface: Smooth.

B. Crossbars
   1. Spacing: 4 inches on center.
   2. Shape: Round, hexagonal, or square twisted.
   3. Crossbars shall be at right angles to bearing bars.
   4. Crossbars shall be pressure welded to bearing bars.

C. The tops of all bars shall be flush.

D. Provide edge bands of the same size as the bearing bars.

E. Provide checkered plate nosings of 1-1/4-inch to 1-1/2-inch width/face at treads and landing traffic edges.

2.13 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. Continuously seal joined members by continuous welds.

D. 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.

E. Exposed Welded Joints: NOMMA Guideline 1 Joint Finish 2.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.14 FACTORY APPLIED FINISHES – STEEL

A. Prepare surfaces to be primed in accordance with Section 09 90 00.

2.15 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 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 to meet AWS preparation requirements.

B. Supply steel items required to be cast into concrete with setting templates to appropriate sections.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

C. Field weld components indicated on Drawings.

D. Perform field welding in accordance with AWS D1.1.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. Steel Bar Grating Installation Requirements:
1. Install level and rattle free.
2. Bearing bars shall bear on supports with 1-inch minimum bearing.
3. Crossbars shall be on the topside.
4. Notching of bearing bars shall not be permitted.
5. Attach to supports, except at trench and sump angles, with two grating clamps per panel per support.

G. Filler and/or shim plates shall be furnished and installed by the Contractor to provide alignment of members where required due to mill and/or fabrication tolerances.

H. After erection, touch up welds, abrasions, and damaged finishes with prime paint or galvanizing repair paint to match shop finishes.

3.4 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story or for every 12 feet in height whichever is greater, non-cumulative.

B. Maximum Offset From Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. Miscellaneous metal fabrications and fasteners shall be inspected after installation to meet requirements in the Drawings and this Specification.

B. Inspection of welding shall be in accordance with AWS and special inspection requirements of ICC International Building Code with all welds visually inspected.

C. Acceptance of welding inspection results shall be in accordance with of AWS.

D. Acceptance of welding test results shall be in accordance with of AWS.

3.6 REPAIR AND CLEANING

A. Abraded and scarred areas and connections on painted surfaces exposed to view shall be repaired per manufacturer’s written instructions with matching field-applied repair coatings and with a minimum dry film thickness equal to that previously applied to the steel.

B. Abraded and scarred areas on galvanized surfaces shall be repaired with cold galvanizing compound in accordance with ASTM A780 with a minimum dry film thickness of 8 mils.

C. Wet storage stains on stainless and galvanized steel shall be removed after installation.

D. Abraded and scarred areas on fusion-bonded epoxy-coated surfaces shall be repaired with patching compound in accordance with the manufacturer's written instructions and specifications with a minimum dry film thickness of 10 mils.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel pipe and tube railings.

2. Steel guardrails.

B. Related Requirements:

1. Section 055116 "Metal Floor Plate Stairs" for metal plate stairs.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
2. Fittings and brackets.
3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.

    a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

C. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

D. Evaluation Reports: For post-installed anchors , from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Pipe and Tube Railings:

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. Pisor Industries, Inc.
   b. Sharpe Products
   c. Wagner, R & B, Inc.
2. Source Limitations: Obtain each type of railing from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

   a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
   b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F

2.3 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.4 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 FASTENERS

A. General: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
3. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.6 MISCELLANEOUS MATERIALS

A. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Shop Primers: Provide primers that comply with Section 099123 "Interior Painting".

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

F. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. <Insert, in separate subparagraphs, manufacturer's name>.

G. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

H. Intermediate Coats and Topcoats: Provide products that comply with "Interior Painting,"and Section 099600.

I. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

a. <Insert, in separate subparagraphs, manufacturer's name>.

J. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
2. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

    a. <Insert, in separate subparagraphs, manufacturer's name>.

K. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

L. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.7 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

Q. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.8 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize all steel railings, including hardware, after fabrication.

2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning

1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated railings with Section 099123 "Interior Painting" unless zinc-rich primer is indicated.
2. Do not apply primer to galvanized surfaces.

G. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

D. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
   1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

   1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
   2. For hollow masonry anchorage, use toggle bolts.
   3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
   4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
   5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
   6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

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. Wood blocking and nailers.
2. Wood furring and grounds.
3. Plywood backing panels.
4. Sheathing and Roof Sheathing

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
2. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that

periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Certified Wood: Materials shall be produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship

1. Dimension lumber framing.
2. Miscellaneous lumber.

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

C. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Furring.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species

1. Hem-fir (north); NLGA.

2. Mixed southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
6. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.
8. Eastern softwoods; NeLMA.

C. For concealed boards, provide lumber with 15percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Eastern softwoods; No. [2] [3] Common grade; NeLMA.
5. Northern species; No. [2] [3] Common grade; NLGA.
6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.3 ROOF SHEATHING

A. Oriented-Strand-Board Roof Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 3/4 inch.

2.4 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

1. Plywood 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."

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

B. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

D. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative laminate and cabinet hardware and accessories.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets installed in architectural plastic-laminate cabinets.
4. Apply WI Certified Compliance Program label to Shop Drawings.
5. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Wilsonart International; Div. of Premark International, Inc. Colors and patterns as indicated on drawings.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

   1. Provide labels and certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
   2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom.

C. Certified Wood: Plastic-laminate cabinets shall be made from wood products certified as "FSC Pureaccording to FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship," and FSC STD-40-004, "FSC Standard for Chain of Custody Certification."

D. Type of Construction: Face frame.

E. Cabinet, Door, and Drawer Front Interface Style: Reveal overlay.

F. Reveal Dimension: 1/2 inch>.

G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality 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. Formica Corporation.
      b. Lamin-Art, Inc.
      c. Panolam Industries International, Inc.
      d. Wilsonart International; Div. of Premark International, Inc.

H. Laminate Cladding for Exposed Surfaces:

   1. Horizontal Surfaces Other Than Tops: Grade HGS.
   2. Vertical Surfaces: Grade HGS.
   3. Edges: PVC edge banding, 0.3 inch thick, matching laminate in color, pattern, and finish.

I. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS].

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

J. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

K. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

L. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints.

M. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations.

2.3 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGP.

C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by manufacturer's designations.

D. Grain Direction: Parallel to cabinet fronts.

E. Edge Treatment: Same as laminate cladding on horizontal surfaces.

F. Core Material: Exterior-grade plywood.

G. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

H. Paper Backing: Provide paper backing on underside of countertop substrate.

2.4 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
1. Composite Wood and Agrifiber Products: Products 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. Medium-Density Fiberboard: ANSI A208.2, Grade 130

3. Softwood Plywood: DOC PS 1, medium-density overlay.

2.5 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, [100] [135] [170] degrees of opening[, self-closing].

C. Back-Mounted Pulls: BHMA A156.9, B02011.

D. Wire Pulls: Back mounted, solid metal, 5 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.

E. Catches: Magnetic catches, BHMA A156.9, B03141].

F. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

G. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

H. Drawer Slides: BHMA A156.9.

1. Grade 1 and Grade 2: Side mounted full-extension type; zinc-plated steel with polymer rollers.
2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
4. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.

I. Door Locks: BHMA A156.11, E07121.

J. Drawer Locks: BHMA A156.11, E07041.

K. Door and Drawer Silencers: BHMA A156.16, L03011.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesives: Use adhesives that meet 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. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate cabinets to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check

measurements of assemblies against field measurements before disassembling for shipment.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips

G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
3. Secure backsplashes to walls with adhesive.
4. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Perimeter insulation under slabs-on-grade.
2. Fiberglass batt insulation in metal stud walls.
3. Vapor retarders for slab.
4. Sound attenuation insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:

1. Basis of Design Manufacturer and Product:
   a. Owens Corning. Foamular 150 XPS.
2. Type X, 1.30 lb/cu. ft. 15 psi minimum.

B. Foil-Faced, Polyisocyanurate Board Insulation: ASTM C 1289, Type I, Class 1, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, based on tests performed on unfaced core on thicknesses up to 4 inches.

1. Basis of Design Manufacturer and Product:

   a. Johns Mansville AP Foil Faced Polyisocyanurate Foam Sheathing.

C. Samples for Verification: Full-size units for each type of exposed insulation indicated.

2.2 GLASS-FIBER BLANKET INSULATION

A. Basis of Design manufacturer and product:

1. CertainTeed Corporation. CertaPRO Thermal FSK-25 Faced Batts

B. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim vapor-retarder membrane on 1 face.

C. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:

1. 3-1/2 inches thick with a thermal resistance of 13 deg F x h x sq. ft./Btu at 75 deg F.

2.3 ACOUSTIC INSULATION SOUND CONTROL BATTS

A. Basis of Design manufacturer and product:
1. Johns Mansville Sound Control Batts

B. Formaldehyde-free Fiber Glass Sound Control Insulation: ASTM C 665 Type 1. ASTM E 90 and ASTM E 413. Flame Spread 25. Smoke Developed 25.

2.4 VAPOR RETARDERS

A. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb/1000 sq. ft., with maximum permeance rating of 0.0507 perm.

1. Available Products:

a. Raven Industries Inc.; DURA-SKRIM 6WW.
b. Reef Industries, Inc.; Griffolyn T-65.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.5 AUXILIARY INSULATING MATERIALS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2.6 INSULATION FASTENERS

A. Insulation fasteners as recommended by insulation manufacturer.

B. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Available Products:

a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
c. Gemco; Spindle Type.

2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

a. AGM Industries, Inc.; RC150.
b. AGM Industries, Inc.; SC150.

c. Gemco; Dome-Cap.
d. Gemco; R-150.
e. Gemco; S-150.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Available Products:

a. AGM Industries, Inc.; TACTOO Adhesive.
b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

3.4 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber or Mineral-Wool Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward warm-in-winter side in location indicated of construction, unless otherwise indicated.
    b. Interior Walls: Set units with facing placed toward areas of high humidity

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.6 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Acoustical joint sealants.

B. Related Sections:
1. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
2. Division 8 Section "Glazing" for glazing sealants.
3. Division 9 Section "Gypsum Board" for sealing perimeter joints.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

a. Each kind of sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

E. Qualification Data: For qualified Installer and testing agency.

F. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

G. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

I. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

J. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

K. Field-Adhesion Test Reports: For each sealant application tested.

L. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion for silicone sealant.

2. Warranty Period: 5 years from date of Substantial Completion for urethane sealant.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.
4. Other: 750 g/l

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.

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. Pecora 311 NS Silicone Sealant.
b. VOC < 40 g/L
c. JS #1

B. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

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. Pecora Corporation; 890 NST.
b. VOC 98 g/L
c. JS #2

C. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

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. Pecora Corporation; 898NST.
b. VOC 50 g/L
c. JS #5

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

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. Pecora Corporation; Urexpan NR-201.
b. VOC 50 g/L

c. JS #3

B. Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

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. Pecora Dynatrol I-XL
b. VOC <100 g/L.
c. JS #7

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; AC-20+.
b. VOC 31 g/L
c. JS #4

2.5 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM C-919.

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. Pecora Corporation; AC-20 FTR.
b. VOC 31 g/L
c. JS #6.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants in joints too shallow for backer rod.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
    a. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.
    c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces **JS-#1**.

1. Joint Locations:
   a. Isolation and contraction joints in cast-in-place concrete slabs.
   b. Joints between different materials listed above.
   c. Other joints as indicated..

2. Silicone Joint Sealant: Single component, nonsag, traffic grade, neutral curing.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vert. surfaces/horizontal nontraffic surfaces **JS-#2**.

1. Joint Locations:
   a. Control and expansion joints in unit masonry.
   b. Joints between metal panels.
   c. Joints between different materials listed above.
   d. Perimeter joints between materials listed above and frames of doors windows and louvers.
   e. Control and expansion joints in ceilings and other overhead surfaces.
   f. Other joints as indicated.
2. Silicone Joint Sealant: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal surfaces **JS-#3**.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated.

2. Urethane Joint Sealant: Single component, s/l, traffic grade.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in vert. surfaces/horizontal nontraffic surfaces **JS-#4**.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Tile control and expansion joints.
d. Vertical joints on exposed surfaces of interior unit masonry walls and partitions.
e. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
f. Other joints as indicated.

2. Joint Sealant: Latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces **JS-#5**.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated.

2. Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces **JS-#6**.

1. Joint Location:

a. Acoustical joints where indicated.
b. Other joints as indicated.

2. Joint Sealant: Acrylic Latex Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

G. One hour rated Application **JS-#7**: Use Dynatrol II two part Urethane Sealant with Mineral Wool or other UL rated system.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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 and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
4. Division 08 Section "Door Hardware".
5. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
6. Electrical Section "Access Control" for access control devices installed at door openings and provided as part of a security access control system.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products.
2. Curries Company.
3. Republic Doors.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.

B. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polystyrene.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw

attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Manufacturers Basis of Design:

1. CECO Door Products Imperial Series.

D. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Manufacturers Basis of Design:

1. CECO Door Products Regent Series.

2.4 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames with "closed and tight" miter seams continuously welded on face, finished smooth with no visible seam unless otherwise indicated.
3. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
4. Manufacturers Basis of Design:

a. CECO Door Products SU Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as slip-on drywall types, with "closed and tight" miter seams.
3. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
4. Manufacturers Basis of Design:

a. CECO Door Products DQ Series (Drywall Profile).

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently.

Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

E. Glazing: Comply with requirements in Division 08 Section "Glazing" and with the hollow metal door manufacturer's written instructions.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Knocked Down Frames: Provide frames with locking corner tabs which permit field assembly. Factory install compression type anchors and countersunk screw holes to secure the bottom of the jambs.
4. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
6. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
7. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

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. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

SECTION 083113 - ACCESS DOORS AND FRAMES

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. Access doors and frames for walls and ceilings.

B. Related Requirements:
1. Section 15820 "Duct Accessories" for heating and air-conditioning duct access doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details materials, individual components and profiles, and finishes.

2. Product Data for Credit MR 4.1 and Credit MR 4.2: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.

a. Include statement indicating costs for each product having recycled content.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. Access Panel Solutions.
2. Jensen Industries; Div. of Broan-Nutone, LLC.
3. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
4. Larsen's Manufacturing Company.
5. Williams Bros. Corporation of America (The).

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:

1. Basis-of-Design Product: Larson’s Manufacturing L-DWC
2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Wall and ceiling.
4. Door Size: As indicated on drawings.
5. Uncoated Steel Sheet for Door: Nominal 0.080 inch, 14 gage.

a. Finish: Baked on powder coat finish.

6. Frame Material: 16 gauge steel (.060 inch thick) cold rolled steel with 22 gauge galvanized drywall bead.
7. Hinges: Manufacturer's standard.
8. Hardware: Latch.

D. Hardware:

1. Latch: Cam latch operated by screwdriver.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.

E. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

F. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

G. Aluminum Sheet: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness according to ANSI H35.2.

H. Frame Anchors: Same type as door face.

I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
1. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder locks, furnish two keys per lock and key all locks alike.
2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08311

SECTION 084113: ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section covers Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

B. Types of Kawneer Aluminum Storefront Systems include:
   1. Trifab® VersaGlaze® 451T Framing System OR APPROVED EQUAL
      a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
      b. Thermal
      c. Front, center, back, multi-plane, structural silicone or weatherseal (type B) glazed
      d. Screw spline, shear block, stick, or punched opening
   2. Trifab® VersaGlaze® 451T Framing System – Impact Resistant and Blast Mitigation OR APPROVED EQUAL
      a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
      b. Thermal
      c. Front, center, back, multi-plane, structural silicone or weatherseal (type B) glazed
      d. Impact resistant, blast mitigation glazing
      e. Screw spline, shear block, stick, or punched opening

C. Related Sections:
   1. 079200: Joint Sealants
   2. 084113: Aluminum-Framed Entrances and Storefronts
   3. 085113: Aluminum Windows
   4. 088000: Glazing

1.3 DEFINITIONS

A. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary (AAMA AG-13).

1.4 PERFORMANCE REQUIREMENTS

A. General Performance:

1. Product to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of aluminum storefront systems representing those indicated for this project.
2. Aluminum storefront systems shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Failure includes any of these events:
    a. Thermal stresses transferring to building structure
    b. Glass breakage
    c. Loosening or weakening of fasteners, attachments, and other components
    d. Failure of operating units

B. Delegated Design:
1. Design aluminum storefront systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Leakage:
1. The test specimen shall be tested in accordance with ASTM E 283.
2. With interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.2 psf (300 Pa).
3. Without interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 1.6 psf (75 Pa).
4. CSA A440 Fixed Rating

D. Water Resistance:
1. The test specimen shall be tested in accordance with ASTM E 331.
2. There shall be no leakage at a minimum static air pressure differential of:
    a. 8 psf (383 Pa) as defined in AAMA 501.
    b. 10 psf (479 Pa) as defined in AAMA 501 with VersaGlaze® HP Sill Flashing.
    c. 8 psf (383 Pa) as defined in AAMA 501 with optional Air/Vapor Barrier Tie-in.

E. Uniform Load Structural:
1. A static air design load of 35 psf (1680 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330.
2. There shall be no deflection in excess of L/175 of the span of any framing member.
3. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

F. Seismic:
1. When tested to AAMA 501.4, system must meet design displacement (elastic) of 0.010 times the story height and ultimate displacement (inelastic) of 1.5 times the design displacement.

G. Thermal Movements:
   1. Allow for thermal movements resulting from the following:
      a. 0°F (-18 C) to 180°F (82 C) maximum change (range) in ambient and surface temperatures
      b. 75°F (24 C) test interior ambient air temperature
   2. Test performance shows no buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5 for a minimum 3 cycles.

H. Thermal Transmittance (U-factor):
   1. Thermal transmittance test results are based upon 1" (25.4 mm) clear high-performance insulating glass [1/4" (e=0.035, #2), 1/2" aluminum spacer and argon fill gas, 1/4"].
   2. When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than listed here:
      a. Trifab® Versaglaze® 451T Framing System, Front Plane (0.28 COG) 0.40 Btu/hr/ft^2/°F per AAMA 507.

I. Condensation Resistance Factor (CRF):
   1. The glass to exterior CRF, when tested to AAMA Specification 1503, shall not be less than 70_{frame} and 69_{glass} (low-e) or 69_{frame} and 58_{glass} (clear)
   2. The glass to center CRF, when tested to AAMA Specification 1503, shall not be less than 62_{frame} and 68_{glass} (low-e) or 63_{frame} and 56_{glass} (clear)
   3. The glass to interior CRF, when tested to AAMA Specification 1503, shall not be less than 56_{frame} and 67_{glass} (low-e) or 54_{frame} and 58_{glass} (clear)

J. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC):
   1. Sound transmission loss test results in accordance with AAMA 1801 are based upon 1" (25.4 mm) clear double laminated insulating glass with PVB interlayer (1/8", 0.030", 1/8", 1/2" AS, 1/8", 0.030", 1/8").
   2. The glass to exterior ratings, when tested to ASTM E1425 and ASTM E90, shall not be less than STC 38 and OITC 31.
   3. The glass to center ratings, when tested to ASTM E1425 and ASTM E90, shall not be less than STC 37 and OITC 30.
   4. The glass to interior ratings, when tested to ASTM E1425 and ASTM E90, shall not be less than STC 38 and OITC 30.

K. Impact Resistance Performance:
   1. The test specimen shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203.
   2. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.

L. Blast Mitigation Performance:

1. The test specimen shall be tested or proven through analysis to meet ASTM F1642, GSA-TS01, and UFC 04-010.01 performance criteria.

M. Environmental Product Declaration (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

1.5 SUBMITTALS

A. Product Data:
   1. For each type of aluminum-framed storefront system indicated, include:
      a. Construction details
      b. Material descriptions
      c. Dimensions of individual components and profiles
      d. Hardware
      e. Finishes
      f. Installation instructions
   2. Environmental Product Declaration (EPD):
      a. Include a Type III Product-Specific EPD created from a Product Category Rule.
   3. Material Ingredient Reporting:
      a. Include documentation for material reporting that has a complete list of chemical ingredients to at least 100 ppm (0.01%) that covers 100% of the product.

B. Shop Drawings:
   1. Plans
   2. Elevations
   3. Sections
   4. Details
   5. Hardware
   6. Attachments to other work
   7. Operational clearances
   8. Installation details

C. Samples for Initial Selection:
   1. Provide samples for units with factory-applied color finishes.
   2. Provide samples of hardware and accessories involving color selection.

D. Samples for Verification:
   1. Provide a verification sample for aluminum-framed storefront system and required components.

E. Product Test Reports:

1. Provide test reports for each type of aluminum-framed storefront used in the project.
2. Test reports must be based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency.
3. Test reports must indicate compliance with performance requirements.

F. Fabrication Sample:
1. Provide a fabrication sample of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
a. Joinery, including concealed welds
b. Anchorage
c. Expansion provisions
d. Glazing
e. Flashing and drainage

G. Supply Chain Sustainability Documentation:
1. Provide EcoVadis certification or equivalent.
2. Provide policy document in place to prevent modern slavery, forced labor, human trafficking, and other forms of labor exploitation in supply chain.

H. Entrance Door Hardware Schedule:
1. Schedule shall be prepared by or under the supervision of supplier.
2. Schedule shall detail fabrication and assembly of entrance door hardware, including procedures and diagrams.
3. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer must have successfully installed the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications:
1. Manufacturer must be capable of providing aluminum-framed storefront systems that meet or exceed performance the stated performance requirements.
2. Manufacturer must document this performance by the inclusion of test reports and calculations.

C. Source Limitations:
1. Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options:

1. Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Product Requirements Section. Do not modify size and dimensional requirements.
2. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups:
1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
2. Build mockups for the type(s) of storefront elevation(s) indicated, in location(s) shown on drawings.

F. Pre-installation Conference:
1. Conduct conference at project site to comply with requirements in Division 01 Project Management and Coordination Section.

G. Structural-Sealant Glazing must comply with ASTM C 1401, “Guide for Structural Sealant Glazing” for design and installation of structural-sealant-glazed systems.

H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 PROJECT CONDITIONS

A. Field Measurements:
1. Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication.
2. Indicate measurements on shop drawings.

1.8 WARRANTY

A. Submit manufacturer's standard warranty for owner's acceptance.

B. Warranty Period:
1. Two years from Date of Substantial Completion of the project provided however that in no event shall the Limited Warranty begin later than six months from date of shipment by manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product:
1. Kawneer Company, Inc.
2. Trifab® VersaGlaze® 451T Framing System

a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
b. Thermal
c. Front, structural silicone glazed
d. Screw spline, shear block, stick, or punched opening

B. Subject to compliance with requirements, provide a comparable product by the following:
1. Manufacturer: YKK; Series: YES 45TU; Profile Dimension: 2” x 4 ½”
2. Manufacturer: Oldcastle Building Envelope; Series: 3000XT; Profile Dimension: 2” x 4 ½”

C. Substitutions:
1. Refer to Division 01 Substitutions Section for procedures and submission requirements.
2. Pre-Contract (Bidding Period) Substitutions:
a. Submit written requests ten (10) days prior to bid date.
3. Post-Contract (Construction Period) Substitutions:
a. Submit written request in order to avoid installation and construction delays.
4. Product Literature and Drawings:
a. Submit product literature and drawings modified to suit specific project requirements and job conditions.
5. Certificates:
a. Submit certificate(s) certifying that the substitute manufacturer (1) attests to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacture, and fabrication of aluminum storefronts for a period of not less than ten (10) years. (*Company Name*)
6. Test Reports:
a. Submit test reports verifying compliance with each test requirement required by the project.
7. Samples:
a. Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

D. Substitution Acceptance:
1. Acceptance will be in written form, either as an addendum or modification.
2. Acceptance will be documented by a formal change order signed by the owner and contractor.

2.2 MATERIALS

A. Aluminum Extrusions:
1. Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish.
2. Not less than 0.070" (1.8 mm) wall thickness at any location for the main frame
3. Complying with ASTM B221: 6063-T6 alloy and temper

B. Fasteners:

1. Nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories:

1. Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.
2. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

D. Reinforcing Members:

1. Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating.

E. Sealant:

1. For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances:

1. References to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

G. Red List Free:

1. Product does not contain PVC or Neoprene.

2.3 STOREFRONT FRAMING SYSTEM

A. Thermal Barrier:

1. Kawneer IsoLock® Thermal Break with dual nominal 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
2. Thermal break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Brackets and Reinforcements:

1. Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.

C. Fasteners and Accessories:

1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials.
2. Where exposed, fasteners and accessories shall be stainless steel.

D. Perimeter Anchors:
   1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

E. Packing, Shipping, Handling, and Unloading:
   1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection:
   1. Store materials so that they are protected from exposure to harmful weather conditions.
   2. Handle material and components to avoid damage.
   3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

2.4 GLAZING SYSTEMS

A. Glazing to meet requirements in Division 08 Glazing Section.

B. Glazing Gaskets:
   1. Manufacturer's standard compression types
   2. Replaceable, extruded EPDM rubber

C. Spacers and Setting Blocks:
   1. Manufacturer's standard elastomeric type

D. Bond-Breaker Tape:
   1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants for structural-sealant-glazed systems as recommended by manufacturer for joint type, and as follows:
   1. Structural Sealant:
      a. ASTM C 1184
      b. Single-component neutral-curing silicone formulation that is compatible with the system components with which it comes in contact
      c. Specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in the aluminum-framed systems indicated
      d. Color: Black
   2. Weatherseal sealant:
      a. ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O
      b. Single-component neutral-curing formulation that is compatible with the structural sealant and other system components with which it comes in contact

c. Recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use

d. Color: Matching structural sealant

2.5 ACCESSORY MATERIALS

A. Joint Sealants:

1. For installation at perimeter of aluminum-framed systems, as specified in Division 07 Joint Sealants Section.

B. Bituminous Paint:

1. Cold-applied asphalt-mastic paint
2. Complies with SSPC-Paint 12 requirements except containing no asbestos
3. Formulated for 30-mil (0.762 mm) thickness per coat

2.6 FABRICATION

A. Fabricate framing member components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations
2. Accurately fitted joints that are flush, hairline, and weatherproof
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior
4. Physical and thermal isolation of glazing from framing members
5. Accommodations for thermal and mechanical movements of glazing and framing that maintain required glazing edge clearances
6. Provisions for field replacement of glazing
7. Fasteners, anchors, and connection devices that are concealed from view to the greatest extent possible

B. Mechanically Glazed Framing Members:

1. Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members:

1. Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing:

1. Fabricate components for assembly using manufacturer’s standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in project according to shop drawings.

2.7 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:

1. Kawneer Permanodic® AA-M10C21A41, AAMA 611, Architectural Class I Clear Anodic Coating, Color #14 Clear.

PART 3 EXECUTION

3.1 EXAMINATION

A. With installer present, examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work:

1. Verify rough opening dimensions.
2. Verify levelness of sill plate.
3. Verify operational clearances.
4. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components for proper water management.
5. Masonry Surfaces:
    a. Masonry surfaces must be visibly dry and free of excess mortar, sand, and other construction debris.
6. Wood Frame Walls:
    a. Wood frame walls must be dry, clean, sound, well nailed, free of voids, and without offsets at joints.
    b. Ensure that nail heads are driven flush with surfaces in opening and within 3" (76.2 mm) of opening.
7. Metal Surfaces:
    a. Metal surfaces must be dry and clean (free of grease, oil, dirt, rust, corrosion, and welding slag).
    b. Ensure that metal surfaces are without sharp edges or offsets at joints.

B. Proceed with installation only after correcting unsatisfactory conditions.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system so that components:

1. Are level, plumb, square, and true to line

2. Are without distortion and do not impede thermal movement
3. Are anchored securely in place to structural support
4. Are in proper relation to wall flashing and other adjacent construction

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather-tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
1. Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
2. Conduct tests for air infiltration and water penetration with manufacturer's representative present.
3. Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.
4. Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
5. Air Infiltration Tests:
   a. Conduct tests in accordance with ASTM E 783.
   b. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
6. Water Infiltration Tests:
   a. Conduct tests in accordance with ASTM E 1105.
   b. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf (300 Pa).

B. Manufacturer's Field Services:
1. Upon owner's written request, provide periodic site visit by manufacturer's field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjusting: Not applicable.

B. Protection:
1. Protect installed product's finish surfaces from damage during construction.

C. Cleaning:

1. Clean glass immediately after installation.
    a. Comply with glass manufacturer's written recommendations for final cleaning and maintenance.
    b. Remove non-permanent labels and clean surfaces.
2. Clean aluminum surfaces.
3. Avoid damaging protective coatings and finishes.
4. Remove excess sealants, glazing materials, dirt, and other substances.
5. Repair or replace damaged installed products.
6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
7. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 084113

SECTION 085113 - ALUMINUM WINDOWS

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 aluminum windows for exterior locations.

B. Related Requirements: Section 088000 “Glazing.”

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size. The color will match pre-engineered metal building window color.

D. Samples for Initial Selection: For units with factory-applied color finishes.

1. Include similar Samples of hardware and accessories involving color selection.

E. Samples for Verification: For aluminum windows and components required, showing color to match pre-engineered metal building window color, and prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Field quality-control reports.

C. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer Company Inc. Series TR-2800 -2-1/4” Depth (Thermally Broken) Fixed Window or comparable product by one of the following:

1. EFCO Corporation; a Pella company.
2. TRACO.

C. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AMMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: AW.
2. Minimum Performance Grade: 40

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.58 Btu/sq. ft. x h x deg F.

D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30

E. Condensation-Resistance Factor (CRF): Provide aluminum windows tested for thermal performance according to AAMA 1503, showing a CRF of 57.

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F, ambient; 180 deg F material surfaces.

G. Sound Transmission Class (STC): Rated for not less than 34 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

H. Outside-Inside Transmission Class (OITC): Rated for not less than 28 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

I. Windborne-Debris Resistance: Capable of resisting impact from windborne debris based on testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 and requirements of authorities having jurisdiction.

2.3 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:
1. Fixed.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units: ASTM E 2190, certified through IGCC as complying with requirements of IGCC.

1. Glass: ASTM C 1036, Type 1, Class 1, q3.

a. Tint: Clear –match Prefabricated Manufacturer standards.
b. Kind: Fully tempered where indicated on Drawings.

2. Lites: Two.
3. Filling: Fill space between glass lites with air.
4. Low-E Coating: Pyrolytic on second surface

D. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

1. Dual Glazing:

a. Interior Lite: Glass.
b. Exterior Lite: Glass.

E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As indicated by manufacturer's designations

F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to the greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Exterior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as

specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting, modified-acrylic or polyester enamel primer/topcoat system complying with AAMA 2603, except with a minimum dry film thickness of 1.5 mils, medium gloss.
2. Color: Match awarded Pre-engineered Metal Building Window Color

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

B. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

C. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 085113

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware, power supplies, back-ups and surge protection.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 80 - Fire Doors and Windows.
4. NFPA 101 - Life Safety Code.
5. NFPA 105 - Installation of Smoke Door Assemblies.
6. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series
2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 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.

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.

2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. 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, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

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. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders 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.

C. 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 in good standing 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.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier 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.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:

1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:

   a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
   b. Door Closers: Comply with the following maximum opening-force requirements indicated:

      1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
      2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

   c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.

3. NFPA 101: Comply with the following for means of egress doors:

   a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

   b. Thresholds: Not more than 1/2 inch high.

4. Fire-Rated Door Assemblies: Provide door hardware for 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 NFPA 252 (neutral pressure at 40" above sill) or UL-10C.

   a. Test Pressure: Positive pressure labeling.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced 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 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 Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) 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. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:
1. Twenty five years for manual surface door closers.
2. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

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 where indicated in the Hardware Sets or on Drawings:

    a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:

        1) Out-swinging exterior doors.
        2) Out-swinging access controlled doors.
        3) Out-swinging lockable doors.

5. Acceptable Manufacturers:

    a. Bommer Industries (BO).
    b. Hager Companies (HA).
    c. McKinney Products (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:

    a. Bommer Industries (BO).
    b. McKinney Products (MK).
    c. Pemko Manufacturing (PE).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Acceptable Manufacturers:

    a. Hager Companies (HA) - ETW-QC (# wires) Option.
    b. McKinney Products (MK) - QC (# wires) Option.

B. Electric Door Hardware Cords: Provide electric 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 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. Acceptable Manufacturers:

    a. McKinney Products (MK) – QC-C Series.

    Provide one each of the following tools as part of the base bid contract:

    a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney Products (MK) - Connector Hand Tool: QC-R003.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. 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. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:

    a. Door Controls International (DC).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

    a. Acceptable Manufacturers:

        1) Hiawatha, Inc. (HI).
        2) Rockwood Manufacturing (RO).
        3) Trimco (TC).

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.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Acceptable Manufacturers:

a. Arrow Lock.
b. No Substitution – Facility Standard.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. 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.
5. Keyway: Manufacturer’s Standard.

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.

E. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:

1. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.

F. Key Quantity: Provide the following minimum number of keys:

1. Top Master Key: One (1)
2. Change Keys per Cylinder: Two (2)
3. Master Keys (per Master Key Group): Two (2)
4. Grand Master Keys (per Grand Master Key Group): Two (2)
5. Construction Keys (where required): Ten (10)
6. Construction Control Keys (where required): Two (2)
7. Permanent Control Keys (where required): Two (2)

G. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by

project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

H. Key Registration List: Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

I. 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. Acceptable Manufacturers:

a. Lund Equipment (LU).
b. MMF Industries (MM).
c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 2 (Standard Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 certified cylindrical (bored) locksets furnished in the functions as specified in the Hardware Sets. Lock chassis fabricated of heavy gauge steel, zinc dichromate plated, with through-bolted application. Furnish with standard 2 3/4” backset and 1/2" throw brass or hardened steel latchbolt. Locks are to be non-handed and fully field reversible.

1. Acceptable Manufacturers:.

a. Yale Lock (AW) - RL Series.
b. No Substitution – Facility Standard.

B. Lock Trim Design: As specified in Hardware Sets.

2.7 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.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.

3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

2.8 ELECTRIC STRIKES

A. Hybrid ANSI Electric Strikes: ANSI A156.31, Grade 1, concealed electric strike combined with an integrated HID® proximity card reader. Designed to work with any Wiegand-compatible controller and fit within a standard ANSI frame prep per SDI-129-04 with no frame interference. External antenna provides flexibility for location in either inswing or outswing applications. Accommodates up to 5/8" latchbolts and includes door position switch, latchbolt monitor, LED and buzzer as standard features.

1. Acceptable Manufacturers:

a. HES (HS) - RF Series.

B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Acceptable Manufacturers:

a. HES (HS) - RF9600 Series.

C. 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.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is not acceptable except in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.
   b. Where function of exit device requires a cylinder, provide an interchangeable core type keyed cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Rail Sizing: Provide exit device rails factory sized for proper door width application.

7. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Standard Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device bar and push rails to be constructed of heavy-duty wrought steel. Exit device covers to be steel or aluminum material; plastic or thermoplastic rails and covers are not acceptable. Provide trim furnished in standard architectural finishes matching the trims and finishes on specified locksets.

1. Acceptable Manufacturers:

   a. Arrow Lock (AW) - S1250 Series.
   b. No Substitution – Facility Standard.

2.10 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 including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. 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 physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

    a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
    b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
    c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
    d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

B. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade 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, closing sweep, and latch speed control valves. Provide non-handed units standard.

1. Acceptable Manufacturers:

    a. Norton Door Controls (NO) - 8500 Series.
    b. No Substitution – Facility Standard.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following:

    a. Stainless Steel: 300 series, 050-inch thick, with countersunk screw holes (CSK).

4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.

5. Acceptable Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified 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. Acceptable Manufacturers:

    a. Hiawatha, Inc. (HI).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

    a. Rixson Door Controls (RF).
    b. Rockwood Manufacturing (RO).
    c. Sargent Manufacturing (SA).

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 UBC 7-2, 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, based on testing according to ASTM E 1408.

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. Acceptable Manufacturers:

1. Pemko Manufacturing (PE).
2. Reese Enterprises, Inc. (RS).
3. Zero International (ZE).

2.14 ELECTRONIC ACCESSORIES

A. 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. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) – 3280 Series.
b. Security Door Controls (SD) - DPS Series.
c. Securitron (SU) - DPS Series.

B. Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single, dual, or multi-voltage units as shown in the hardware sets. Units must be expandable up to eight Class 2 power limited outputs. Units must include the capability to incorporate a battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Acceptable Manufacturers:

    a. Securitron (SU) - AQ Series.

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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
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. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. 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: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

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. and 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 SCHEDULE

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.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. AW - Arrow Lock
4. HS - HES
5. RF - Rixson
6. NO - Norton
7. PE - Pemko
8. SU - Securitron

Set: 1.0
Doors: 113A, 113B, 114A

2	Hinge (heavy weight)	T4A3386 x NRP 4-1/2" x 4-1/2"	US32D	MK
1	Electric Hinge (heavy weight)	T4A3386-QC12 4-1/2" x 4-1/2"	US32D	MK
1	Mortise Lock (fail-secure)	AUR 8891FL 2196 REX	626	YA
1	Door Closer	CPS7500T	689	NO
1	Kick Plate	K1050 8" 4BE	US32D	RO

1	Threshold	2005AT MSES25SS (2006AT at dr 124.2)	PE
1	Rain Guard	346C	PE
1	Gasketing	S773BL	PE
1	Sweep	3452CNB	PE

Notes: Electronic opening to operate as follows: Outside, Card reader (Included with electric strike) signals power supply to release fail secure electric strike allowing entry by lever. Key override. Inside, Free egress at all times by exit device.

Set: 2.0
Doors: 015A, 101B

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (classroom)	AUR 8808FL 2196	626	YA
1	Door Closer	7500	689	NO
1	Kick Plate	K1050 8" 4BE	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
3	Silencer	608 (or) 609	GRY	RO

Set: 3.0
Doors: 007A, 008A, 011A, 111A, 112A

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (privacy)	AUR 8802FL IND	626	YA
1	Door Closer	7500	689	NO
1	Mop Plate	K1050 4" 4BE	US32D	RO
1	Kick Plate	K1050 8" 4BE	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
3	Silencer	608 (or) 609	GRY	RO

Set: 4.0
Doors: 002A, 013A, 103A, 105A, 115A

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (classroom)	AUR 8808FL 2196	626	YA
1	Door Stop	403 (or) 441CU	US26D	RO
3	Silencer	608 (or) 609	GRY	RO

Set: 5.0
Doors 006A, 018A, 106A, 108A, 110A, 114A

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Mortise Lock (entry/office)	AUR 8807FL 2196	626	YA

1	Door Closer	7500	689	NO
1	Kick Plate	K1050 8" 4BE	US32D	RO
1	Door Stop	403 (or) 441CU	US26D	RO
3	Silencer	608 (or) 609	GRY	RO

Set: 6.0
Doors: 020A

1	Continuous Hinge	MCK-12HD - DOOR HEIGHT	CL	MK
1	Continuous Hinge	MCK-12HD EPT - DOOR HEIGHT	CL	MK
1	Removable Mullion	KRM200 - OPENING HGT	600	YA
1	Stabilizer Kit	M102S	600	YA
1	Exit Device (rim, exit only)	7200 EO	630	YA
1	Exit Device (rim, nightlatch)	7200 P 121NL 1193 x 6-Pin	630	YA
1	Mortise Cylinder	2196	626	YA
2	Door Pull	BF158 Mtg-Type 1	US32D	RO
2	Door Closer	J7500	689	NO
2	Door Stop - HD Floor	471	US26D	RO
1	Threshold	254A MSES25SS		PE
1	Frame Harness	QC-C1500		MK
1	Door Harness	QC-CXXX		MK
1	Electric Power Transfer	EL-CEPT		SU
2	Position Switch	DPS-M-BK		SU
1	Power Supply	781N		YA

Notes: Perimeter/meeting stile seals by door/frame supplier.
Card reader by security integrator.
Electronic Operation: Valid card or key retracts latchbolt. Free egress at all times. In case of power loss, door remains locked.

Set: 7.0
Doors: 017A, 116A

2	Continuous Hinge	MCK-12HD - DOOR HEIGHT	CL	MK
2	Push/Pull Bar Set	BF15847 T1	US32D	RO
2	Door Closer	J7500	689	NO
2	Door Stop	403 (or) 441CU	US26D	RO

Notes: Perimeter/meeting stile seals by door/frame supplier.

END OF SECTION 087100

SECTION 087163 - DETENTION DOOR HARDWARE

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 detention door hardware for the following:

1. Swinging detention doors.

B. Related Requirements:
1. Section 285213 “Detention Interfaces to Access Control Systems” for new and existing door integration into the new Door Control System / SAAS TSCS.

1.3 COORDINATION

A. Templates: Obtain and distribute, to the parties involved, templates for detention doors, frames, and other work specified to be factory prepared for installing detention door hardware.

B. Electrical System Roughing—In: Coordinate layout and installation of electrically powered detention door hardware with connections to power supplies, and detention door monitoring and control system.

C. For all new and existing Detention door, frame and hardware work, the General Contractor is to provide a Detention Equipment Contractor to install and coordinate material for this work.

D. DEC is to coordinate with Security Equipment Contractor to ensure all detention door material including door control system (Security Control System) integrates and provide the intended controls. Coordination meetings to be provided to verify these items prior to ordering.

1.4 PREINSTALLATION MEETINGS

A. Detention Keying Conference: Conduct conference at Project site. In addition to Owner, Contractor, and Architect, conference participants shall also include Installer. Incorporate detention keying conference decisions into Project's final Detention Keying Schedule after reviewing detention door hardware keying system including, but not limited to, the following:

1. Preliminary key system schematic diagram.
2. Requirements for key-control system.
3. Requirements for access control.
4. Address for delivery of keys.
5. Existing keying system.

B. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss power and control system roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of detention door hardware.
3. Review and finalize a construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Certifying procedures.
5. Coordination of the Detention Equipment Contractor (DEC) and the Security Equipment Contractor (SEC) in order to ensure the

1.5 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 each type of detention door hardware.

B. Shop Drawings: For each type of detention door hardware.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring; differentiate between manufacturer-installed and field-installed wiring for detention door hardware. Include the following:

a. System schematic.
b. Point-to-point wiring diagram, including location of connections.
c. Riser diagram.
d. Elevation of each detention door type.

3. Detail interface between electrically powered detention door hardware and detention door/access monitoring and control system.

C. Detention Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware as well as installation procedures and wiring diagrams. Coordinate the Detention Door Hardware Schedule with detention doors, frames, and Door Control Systems equipment and contractor and other related work to ensure proper size, thickness, hand, function, controls, monitoring, and finish of detention door hardware.

1. Integrate detention door hardware indicated in "Detention Door Hardware Schedule" Article into Project's final Detention Door Hardware Schedule, and indicate complete designations of every item required for each detention door and opening.
2. Keying Schedule: Coordinate detention keying with other door hardware in Project's final Keying Schedule.
3. Indicate each detention lock and type of key cylinder using the following prefixes: "P" for paracentric, and "M" for mogul.
4. Indicate security level of each item.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer, supplier, and Architectural Hardware Consultant.
1. A qualified Detention Equipment Contractor (DEC) is to provide, coordinate and install all work associated with the detention doors on this project. The DEC and the Security Equipment Contractor (SEC) who is providing and installing the Door Control System, are to coordinate door hardware and Door Control System operations to ensure wiring,

programming, and hardware are compatible and as required to provide for the specified operations of the detention door control system as a whole.

2. DEC to have a minimum of 3 years of experience working in correctional facilities as a DEC on projects of this size or larger.
3. DEC to have completed at least 2 retrofit door lock and surface mounted lock projects of similar size.
4. Any sub trade to the DEC on this project must also meet the same criteria as the DEC as outlined herein.
5. DEC is responsible for installer certification verification.
6. Manufacturer shall provide the certified installer with a certificate designating him/her as a qualified installer for this product.

B. Product Certificates: For each type of detention door hardware.

1. Certify that detention door hardware complies with listed fire door assemblies.

C. Product Test Reports: For each type of detention lock and latch and security door closer for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Examination reports documenting inspections of substrates, areas, and conditions.

E. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

F. Field quality-control reports documenting inspections of installed products.

1. Field quality-control certification signed by Contractor and Detention Equipment Contractor.

G. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For detention door hardware 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. Normal remote security operation.
b. Normal local security operation.
c. Emergency security operation.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of detention door hardware.

B. Initial Maintenance Service: Beginning at Substantial Completion, provide three months' full maintenance by skilled employees of detention door hardware Installer. Each building will have a Substantial Completion date separate from other buildings, this will be in effect for each building, therefore the Installer would be onsite during much of this Maintenance Service completing other

buildings. The last few buildings would require Maintenance Service to extend after the Installer is completed with the project and off site. Include monthly preventive maintenance, repair or replacement of *worn* or defective components, lubrication, cleaning, and adjusting as required for proper detention door hardware operation. Provide parts and supplies the same as those used in the manufacture and installation of original equipment. Provide separate line item in the Schedule of Values for payment for this service.

C. Furnish extra materials that match products installed and that are packaged with protective covering for
   a. Provide an additional (1) locks per each lock type on the hardware schedule
   b. Provide an additional (1) closers for the surface mounted closer.
   c. Provide an additional (1) surface mounted pulls.
   d. Provide an additional (1) thresholds.
   e. Provide an additional 10% of weather stripping.
   f. Provide an additional (1) door bottoms and rain drip bars.
   g. Provide an additional (1) armor plate per size indicated in the door schedule.
   h. Provide an additional (2) door stops.
   i. Provide any specialized tools required to work on the electro-mechanical door locks.

1. Electrical Parts:
   a. Provide an additional 3 pigtails/clip connectors and extensions per each electrical lock type on the hardware schedule.

2. Security Fasteners:
   a. Furnish not less than one box for every 50 boxes or fraction thereof, of each type and size of security fastener installed.

3. Tools:
   a. Provide two 2 sets of tools for installing and removing security fasteners.

4. Training:
   a. Provide training for RCI Locksmith and IT staff in association with the new Door Control System training, for operating, trouble shooting, and maintenance of the newly installed door hardware. Film the training and provide 2 DVDs for maintenance purposes.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and an authorized representative of detention door hardware manufacturer for installation and maintenance of units required for this Project.

B. Supplier Qualifications: Detention door hardware supplier with warehousing facilities in Project's vicinity who is, or employs, a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about detention door hardware and keying.

1. Detention Door Hardware Supplier Qualifications: An experienced detention door hardware supplier who has completed projects with electrically powered detention door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.

a. Engineering Responsibility: Prepare data for electrically powered detention door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
b. Scheduling Responsibility: Preparation of Detention Door Hardware and Keying schedules.

C. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for detention door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Architectural Hardware Consultant (AHC).

1.10 DELIVERY, STORAGE, AND HANDLING

A. Inventory detention door hardware on receipt and provide secure lockup for detention door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the Detention Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver detention door keys to Owner by registered mail or overnight package service. Address and contact to be provided at the Pre—Installation meeting.

1.11 MOCK UP

A. Initial mock up:

1. Provide a mock-up of the single lock box for A/E and Owner’s review lock box and associated DPS and electromechanical lock functions and project specifications compliance.

2. Provide on partial door and door frame and provide ability to fully demonstrate the locks electrical and mechanical capabilities.

3. Owner and A/E will review for compliance with specifications.
a. A written report on the mock-up’s conformance with project specifications and requirements will be provided and may require redesign or added functionality of portions of the lock box to provide for project specification compliance.
b. Second mock up may be required to verify any changes requested by Owner and A/E.

B. Final Mock up:
1. Provide single and double lock box mock ups mounted to an existing single jamb door and frame and a shared jamb and door condition, and fully connected to existing door control system for testing, or as otherwise connected to provide for proper testing.
2. Mock ups to be fully functional as to demonstrate full functionality and testing of the lock and lock box requirements.
3. Lock boxes can be used as final product if found to be in compliance with project specifications and approved by Owner and A/E.

1.12 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of detention door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and detention door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering or detention use.

2. Warranty Period: Three years from date of Substantial Completion.
3. Warranty Period for Continuous-Pin Detention Hinges: 10 years from date of Substantial Completion.
4. Warranty Period for Security Door Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Swinging Detention Door Assemblies: Provide detention door hardware as part of a detention door assembly that complies with security grade indicated, when tested according to ASTM F 1450, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

1. Bullet Resistance: Comply with Level 3 rating when tested according to UL 752; where indicated in door schedule.

a. Listed and labeled as bullet resistant by a testing agency acceptable to authorities having jurisdiction.

2. Tool-Attack Resistance: Comply with small-tool-attack-resistance rating when tested according to UL 1034 and UL 437; at all Detention Grade 1 doors.

2 2 DETENTION DOOR HARDWARE, GENERAL

A. Provide detention door hardware for each door as scheduled in "Detention Door Hardware Schedule" Article to comply with requirements in this Section.

1. Detention Door Hardware Sets: Provide quantity, item, size, finish, or color indicated.

2. Sequence of Operation: Provide electrically powered detention door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Electrically Powered Detention Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

a. Detention Door Hardware Control and Monitoring: Provide detention door hardware with features, functions, and internal equipment required to perform control and monitoring functions indicated in Section 285211 "Detention Monitoring and Control Systems" and as otherwise noted in the drawings.

D. Source Limitations: Obtain mechanical detention door hardware from same manufacturer as that of electrically powered or pneumatic detention door hardware.

E. Regulatory Requirements:

1. Fire-Rated Detention Door Assemblies: Provide detention door hardware for assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire- protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL l0C.
2. Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines ICC Al 17.1.

2.3 DETENTION HINGES

A. Gap-Mounted Detention Hinges: Extra heavy weight; two heavy-duty thrust bearings with hardened-steel ball bearings; fabricated from steel plate; 3/4-inch- (19-mm-) diameter, case-hardened, fully welded, steel hinge pin.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems Series 604 FMCS.
b. RR Brink Locking System, Inc.; #4-1/2 Institutional Full Mortise
c. Northwest Specialty Hardware, Inc.; 645 FMST
d. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; **4-1/2 FM** ICS. Basis of Design.
e. Southern Folger Detention Equipment Company; Southern Steel Products; Southern Steel Model No. 204FMSS. Basis of Design.

2. Leaves: Cast Stainless Steel, drilled for countersunk security fasteners, provide with integral security stud.
3. Size: 4'/" x 4'/" x 3/16".
4. Security Grade: 1 according to ASTM F 1758.
5. Finish: BHMA 600 (US32D).
6. Hinge Pin: Stainless Steel.
7. ASTM F1758 Certified.

2.4 MECHANICAL DETENTION LOCKS AND LATCHES

A. Lock Mountings:

1. Hollow-Metal Detention Doors: Mount detention lock to back of 0.183-inch (4.65-mm) nominal-thickness, galvanized-steel cover plate for installation in lock pocket fabricated into detention door. Attach cover plate to hollow-metal detention door with security fasteners.

2. Mortise Mounting: Mortise into door per manufacturer's installation instructions. All exposed fasteners to be Torx-pin type security fasteners.

B. Utility-Door Mechanical Deadlocks, Paracentric Cylinder:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

   a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems 5070 Series
   b. RR Brink Locking System, Inc.; 7070 Series
   c. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; 70 Series. Basis of Design.

2. Function: Lockbolt retracted and extended by six-tumbler paracentric cylinder; keyed two sides.
3. Lockbolt: 1-1/2 inches high by 3/4-inch (38 mm high by 19 mm) thick; 5/8-inch (16-mm) throw.
4. Security Grade: 1 according to ASTM F 1577.

C. Mechanical, Deadlatch/Deadlock, Mortise, Mogul Cylinder:

1. Basis—of—Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

   a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems 92000 Series
   b. RR Brink Locking System, Inc.; 1020 series
   c. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; **D9300.** Basis of Design.
   d. Southern Folger Detention Equipment Company; Southern Steel Products; Southern Steel Model No. 10516.

2. Function: Lockbolt retracted and extended by mogul cylinder; keyed two sides.
3. Latchbolt: 1-1/4 inches high by 11/16-inch (38 mm high by 19 mm) thick; 3/4-inch (16-mm) throw.
4. Deadbolt: 1-1/2 inches high by l l/l 6-inch (38 mm high by 19 mm) thick; 1-inch (16-mm) throw.
5. Security Grade: 1 according to ASTM F 1577.
6. Cylinder: Mogul Cylinder
7. Trim: Lever Handles.

2.5 ELECTROMECHANICAL DETENTION LOCKS AND LATCHES

A. Connectors: Provide electromechanical detention locks and latches with factory-wired plug connector with 6-inch (152-mm) wire pigtail.

1. Provide security ring for installation of electromechanical detention lock in hollow-metal detention frame, welded to frame or access cover.
2. Equip direct-current, solenoid-operated detention locks and latches with diode transient voltage protection at each locking device.

B. Motor-Operated Deadlatches, Paracentric Cylinder:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

   a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems 9724 Series
   b. RR Brink Locking System, Inc.; 7050M Series
   c. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; 56M-6-CL Series. Basis of Design.
   d. Southern Folger Detention Equipment Company; Southern Steel Products; Southern Steel; 1051M Series.

2. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by six-tumbler paracentric cylinder; keyed two sides; if latchbolt is retracted by key. Provide '/ cycle function and 24VDC. Do not provide a key holdback function.

   a. Latchback: Latchbolt remains retracted as long as control switch is activated; latchbolt extends when power is discontinued.
   b. If power fails, latchbolt automatically deadlocks (fail secure).

3. Latchbolt: 2-inch-high by 3/4-inch- (51-mm-high by 19-mm-) thick hardened steel; 3/4-inch (19-mm) throw.
4. Provide internal deadlock indicator switch.
5. Provide roller-type deadlock actuator.
6. Voltage: [120-V ac] or [24-V dc]. Verify electric requirements for existing doors.
7. Listed and labeled for use on fire doors.
8. Security Grade: 1 according to ASTM F 1577.

C. Motor-Operated Deadlatches, Mogul Cylinder: for cell door retrofit in customized lock boxes.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

   a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems 9912M Series
   b. RR Brink Locking System, Inc.; 5020M Series
   c. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; 121MC Half Cycle Series. Basis of Design.
   d. Southern Folger Detention Equipment Company; Southern Steel Products; Southern Steel; 10120AM Series.

2. Function: Remote switch activates electric motor that retracts latchbolt; automatic latching and deadlocking when door is closed (slam locking). Latchbolt can be mechanically retracted by mogul cylinder; keyed one side.

   a. Latchback: Latchbolt remains retracted as long as control switch is in open position; latchbolt extends when control switch is moved to locked position.
   b. If power fails, latchbolt automatically deadlocks (fail secure).

3. Latchbolt: l-l/2-inch-high by 3/4-inch- (38-mm-high by 19-mm-) thick hardened steel; I-inch (25-mm) throw.
4. Provide internal deadlock indicator switch.
5. Provide roller-type deadlock actuator.
6. Voltage: 24-V dc.
7. Listed and labeled for use on fire doors.
8. Security Grade: 1 according to ASTM F 1577.
9. Tampering sensor.

D. Surface Mounted Lock Boxes: for Motor-Operated Deadlatches, Mogul Cylinder in Cell Door Retrofit areas.

1. Basis—of—Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

   a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Defender Retrofit Solution. Basis of Design.

   b. Willow Products Company, Inc, The Wedge with Gripper and Tamper Alarm.

   c. Southern Folger Detention Equipment Company, The Sentinel

   d. Habersham Metal Products Co., Surface Mounted JML

2. Quality:
   a. Maximum Security High Detention Grade design meeting impact testing as follows:
      l) ASTM F1450 Grade I Security Hollow Metal Test.
      2) The lock pocket and strike shall be tested in accordance with ASTM- F l450-12, Section 6, “Specimen Preparation” and Section 7.2 “Door Assembly Impact Test”.

3. Surface mounted lock boxes to have electro-mechanical locks installed per item 2.5 C above and to have the following features at a minimum:
   a. Low Voltage mechanism and lock.
   b. Integral security door position switch per 2.8 B below.
   c. Highly visible 30mm door indicator, LED red/green light integrated into the lock box construction with the following:
      l) 5-sided perforated 12 ga stainless-steel cover attached from interior side of the lock box.
      2) 1/8” thick clear piece of polycarbonate protecting the LED light and located between the light and the perforated metal cover
      3) Minimum Indicator light indications:
         a) Secured condition (Door closed and dead-locked): “Green” Indication
         b) All other unsecured conditions: “Red” indication.
         c) “Green” and “Red” indications shall be clearly visible from secure side of door at all traffic directions and from the control room
      4) LED shall be High-Intensity, daylight visible, Immune to EMI and RFI interference.
   d. Security features that protect the lock bolt from sheeting or popping from inside or outside the inmate cell.
   e. Provide closure cover plates for existing door strike and lock faceplate.
   f. Integral flush pull.
   g. All exposed fasteners to be security torx pin type.
      1) Provide blue lock-tite product at all fasteners.
   h. Cleanout port for lock strike.
   i. Lock Pocket to be designed so as to allow maintenance to remove the lock cover and adjust the lock without removing the lock from the Lock Box.

j. Sloped top and bottom cover to prevent jumping on or prying against the lock pocket.
k. Provide removable cover to allow for easy clean out of the strike pocket.
1. One wiring harness shall be factory wired inside each lock box. This wiring harness shall have a standard connector so that the lock can be easily unplugged for testing with a test box. The mating pigtail shall be furnished for butt splicing to the field wires.
m. Closure plates and security screws for existing strikes, deadlock and DPS faceplates shall be provided and installed by lock box plier.
n. Reference Drawing details l/A7.4 and 2/A7.4.

4. Materials:
   a. Lock box and strike assembly shall be constructed of commercial quality, level, cold-rolled steel conforming to ASTM A 366 or hot-rolled, pickled and oiled steel confirming to ASTM A 569. The steel shall be free of scale, pitting, coil breaks or other surface blemishes. It shall also be free of buckles, waves or any other defects caused by the use of improperly leveled sheets.
   b. Interior Assemblies: Shall be 12 gage or 10 gage as required to meet testing and performance requirements defined in sections above.
   c. Construction of lock box shall be of face sheets having a zinc coating applied by the hot- dip process confirming to ASTM A 653/A 653M Commercial Quality, coating designation A60 or G60 (Z180 or ZF180).

5. Construction
   a. General:
      i. All assemblies shall be of the types and sizes shown on the approved submittal drawings, shall be constructed in accordance with the specifications.
      ii. All exposed fasteners of the lock box and strike assembly shall be Torx with pin, Quantity and positioning of fasteners shall be as needed to meet testing. Secured with thread locking compound.

   b. Anchoring:
      i. The structural integrity of the existing wall must be maintained.
      ii. Lock pocket and strike assemblies shall be field welded to existing frame and door as required to meet test performance criteria in paragraph's above.
         1. Where thereare exposed perimeter field welds of box to frame and door, apply security caulk, continuous between welds. Caulk shall be pick-proof Pecora Dyna-Poxy or equal. Color to match lock pocket body.
         2. Touch up paint for wall shall match existing wall and cover all exposed field welds and areas damaged by field welding or installation.

   c. Electrical
      i. Coordinate the lock controls and wiring with the new door control and monitoring system (locking control system) installation. When lock pocket installation is completed, the indicator LED on lock pocket shall accurately signal green for secure conditions and red for all unsecure conditions. Modifications may be required to the circuitry in order for the 24 VDC DPS and 24 VDC LED to work with the existing locking control panel.

      ii. Existing door control wiring from the door to the mechanical chase approximately 10 — 15 feet away from the door lock will be replaced by the electrical contractor. The DEC is to review and verify the plug connector for this work is compatible with the new door lock plug connector. If additional wiring is required, this will be provided by the owner under another subtrade.

2.6 DETENTION LOCK TRIM

A. Levers: Solid stainless steel.

B. Escutcheons for Paracentric Locks: 0.125-inch- (3.18-mm-) thick, 3-inch- (75-mm-) diameter stainless steel with BHMA 630 finish. Attach with security fasteners.

1. Style: Single or double wing as required by lock function.

C. Cylinder Shields for Paracentric Locks: 0.125-inch- (3.18-mm-) thick, 3-inch- (75-mm-) diameter stainless steel with BHMA 630finish and swinging cover to protect keyhole. Attach with security fasteners.

1. Style: Single or double wing as required by lock function.

2.7 DETENTION CYLINDERS AND KEYING

A. Source Limitations: Subject to compliance with requirements, provide cylinders and keying for paracentric and mogul cylinders by same manufacturer as for detention locks and latches.

B. Paracentric Cylinders: Manufacturer's standard lever—tumbler type, constructed from one—piece spring—tempered brass; with tumblers activated by phosphor bronze springs; five tumblers per lock.

C. Mogul Cylinders: Manufacturer's standard pin-tumbler type, minimum 2-inch (51-mm) diameter; body constructed from brass or bronze, stainless steel, or nickel silver; with stainless-steel tumblers and engaging cylinder balls; complying with the following:

1. Number of Pins: Six. (verify with RCI Locksmith)
2. Manufacturer: Basis of design = Folger Adams.
   a. Equivalent by
      1) Airteq
      2) R.R. Brink
      3) Southern Folger.

3. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.

   a. High-Security Grade: Listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).

4. Finish: BHMA 630.

D. Keying System: Provide a factory-registered keying system complying with the following requirements:

E. Keys: Provide cast silicon-bronze copper alloy keys complying with the following:

1. Stamping: Permanently inscribe each key with a visual key-control number and include the following notation:

   a. Information to be furnished by Owner.

2. Quantity: In addition to one extra blank key for each lock, provide the following:

   a. Cylinder Change Keys: Three.

b. Master Key(s): One.
c. Grand Master Key(s): One.
d. Great—Grand Master Key(s): One

2.8 SWITCHES

A. General: Provide switches configured with contact type required for functions indicated, including multiple circuiting where required by functional performance of Section 2852ll "Detention Monitoring and Control Systems."

A. Strike Indicator Switches: Designed to be mortised behind strike and to indicate whether door is locked or unlocked; enclosed in metal strike box. Wire in series with door position switches. Attach with security fasteners.

1. Voltage: 120-V dc.
2. Locations: Where indicated.
3. Manufacturer: Same as detention lock.

B. Concealed, Magnetic Door Position Switches: Consist of actuating magnet mortised into detention door and switch mortised into frame; with stainless-steel faceplates; 24-V dc, factory wired with plug connector. Wire in series with lock monitors. Attach with security fasteners.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems 6200.
b. RR Brink Locking System, Inc.; 201020.
c. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; ASSW-105A. Basis of Design.
d. Southern Folger Detention Equipment Company, Southern Steel Products; Southern Steel 200 MRS.

2.9 DETENTION OPERATING TRIM

A. Standard: BHMA A156.6, Grade 1.

B. Surface-Mounted Door Pulls: 8-3/4-inch (222-mm) overall length and 2-l/4-inch (57-mm) projection; attach to door with two security fasteners.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule as basis of design or comparable product by one of the following:

a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems 612.
b. NW Specialty Hardware, Inc.; Model # 601
c. RR Brink Locking System, Inc.; Model # 300021.
d. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; No. 2. Basis of Design.
e. Southern Folger Detention Equipment Company; Southern Steel Products; Southern Steel; 2l2C.

2. Material: Cast stainless steel with BHMA 630 finish.

2.10 SECURITY DOOR CLOSERS

A. Standard: BHMA A156.4, Grade 1.

1. Certified Products: Provide security door closers listed in BHMA's "Directory of Certified Door Products."

B. Surface-Mounted Security Door Closers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule and as noted below:
   a. LCN Closers, an Allegion company; 4040XP EDA, 4510
   b. Proposed equals to match or better the specifications of the Basis-of-Design Product:
      1) Corbin Russwin.
      2) Falcon.

2. Arms: Minimum 3/8-inch- (9.5-mm-) thick by l-1/8-inch- (29-mm-) wide, rectangular steel main arm; 5/16-inch- (8-mm-) thick by l-inch- (25-mm-) wide, rectangular steel secondary arm; full rack-and-pinion type; fabricated with orbital-riveted, pinned, or welded elbow and arm shoe/soffit plate joints designed to prevent disassembly with ordinary hand tools.
3. Cover: Heavy-duty metal, attached with four security fasteners.
4. Mounting: Attach security door closer with security fasteners.

C. Unit Size: Comply with manufacturer's written recommendations for size of security door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to comply with field conditions and requirements for opening force.

2.11 DETENTION DOOR STOPS

A. Detention Floor Stops: l-l/2-inch-high by 2-inch- (38-mm-high by 51-mm-) diameter, rubber bumper mounted on steel lag bolt; BHMA A156.16; install in floor with no shrink grout; for detention doors unless wall or other type stops are indicated. Do not mount floor stops where they can impede traffic.

1. Basis—of—Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule and as noted below:

   a. Airteq Systems, a division of Cornerstone Detention Products, Inc.; Airteq Systems Model; # 650.
   b. Ives; Model # FS18L
   c. Hagar Companies; Model # 269T
   d. NW Specialty Hardware, Inc.; Model # 606.
   e. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; 420. Basis of Design.
   f. Southern Folger Detention Equipment Company; Southern Steel Products; Southern Steel; 420.

B. Silencers for Detention Door Frames: BHMA A156.16, Grade l; neoprene or rubber, minimum 1/2-inch (13-mm) diameter; fabricated for drilled-in application to detention door frame. Attach with security fasteners.

2.12 KEY-CONTROL SYSTEM

A. Security Key Cabinets: Metal cabinet for mounting 300 paracentric or mogul keys.

1. Basis—of—Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule and as noted below:

a. Kryptomax, a Texas Correctional Supply Company, GAT-DKC-100-GP
b. DDS Group, a DDS Group Company, Model 7505-300.
c. Southern Folger Detention Equipment Company, Folger Adam Products; Folger Adam Model No.; Model # **6-300.** Basis of Design.

2. Cabinet: Minimum 16 inches (406 mm) wide by 24 inches (610 mm) high by 6-1/2 inches (165 mm) deep; formed from 0.134-inch (3.42-mm) nominal-thickness steel sheet. Provide 0.060-inch (l.52-mm) nominal-thickness, steel-sheet interior panels, supported on pivots.
3. Doors: Formed from same material as cabinet, supported by heavy-duty, continuous, side hinge welded to cabinet and door; with tumbler deadlock.
4. Cross-Index System: Set up by detention key-control manufacturer; include labels, two sets of key tags with self-locking key holders, key-gathering envelopes, temporary and permanent markers, and the following:

a. Card Index: Furnish four sets of index cards for recording key information. Include three receipt forms for each key-holding hook.
b. Computer Software: Furnish cross-index software for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

B. Finishes:

1. Steel Prime Finish: Clean, pretreat, and apply manufacturer's standard primer immediately after cleaning and pretreating.
2. Steel Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat.

a. Color and Gloss: As selected by Architect from manufacturer's full range.

2.13 DOOR SHOES AND OVERHEAD RAIN DRIP

A. General: Provide door shoes and drip bars for hollow metal doors and frames of extruded tempered aluminum 6063-T6.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule or comparable product by one of the following:

a. Pemko Manufacturing Company
b. McKinney
c. Reese

B. Door Shoes:

1. Material: Extruded tempered aluminum 6063-T6.
2. Seal: thermo-plastic elastomer

3. Width: l 3/4 inches (45 mm)
4. Fasteners: Stainless steel, security fasteners as specified herein.
5. Finish (ANSI/BHMA 156.18): Mill finish aluminum
6. Fabrication Option: 1/2 inch (12.7 mm) full notch.
7. Manufacturer Model Number: See door hardware schedule at the end of this section

C. Door Top Overhead Rain Drip:

1. Material: Extruded tempered aluminum 6063-T6
2. Finish: clear anodized aluminum
3. Fasteners: Stainless steel, security fasteners as specified herein.
4. Manufacturer Model Number: See door hardware schedule at the end of this section

2.14 DOOR PROTECTION PLATE

A. General: Door protection plates shall be .050", beveled on 3 sides and shall meet ANSI A156.6 requirements. Plates shall be riveted to door per manufacturer's installation instructions using blind structural rivets and shall be provided with manufacturer's standard warranty. See door schedule at the end of this section.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in hardware schedule or comparable product by one of the following:

a. Rockwood
b. McKinney
c. Trimco

2.15 OTHER HARDWARE

A. For hardware in the Hardware Schedule below not specified in this section, reference Section 087100 "Door Hardware".
1. Weather-stripping/Seals
2. Thresholds.

2.16 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.

B. Base Metals: Produce detention door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified detention door hardware units and BHMA A156.18 finishes.

C. Fasteners: Provide flat—head security fasteners with finished heads to match surface of detention door hardware.

1. Security Fasteners: Fabricate detention door hardware using security fasteners with head style appropriate for fabrication requirements, strength, and finish of adjacent materials. Provide stainless-steel security fasteners in stainless-steel materials.

2. Concealed Fasteners: For detention door hardware units that are exposed when detention door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching detention door hardware. Where using through bolts on hollow-metal detention door and frame construction, provide sleeves for each through bolt.
3. Steel Machine Screws: For the following fire-rated applications:

    a. Mortise detention hinges to detention doors.
    b. Strike plates to detention frames.
    c. Security door closers to detention doors and frames.

4. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

    a. Security door closers to detention doors and frames.

5. Spacers Bolts: For through bolting of hollow-metal detention doors.

D. Detention Lock Construction: Fabricate detention lock case and cover plate from steel plate. Fabricate bolts from solid sections; laminated construction is unacceptable.

2.17 HARDWARE FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. BHMA Designations: Comply with base material and finish requirements indicated by the following:

1. BHMA 600: Primed for painting, over steel base metal.
2. BHMA 606: Satin brass, clear coated, over brass base metal.
3. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
4. BHMA 630: Stainless steel, satin, over stainless-steel base metal.
5. BHMA 633: Satin brass plated, clear coated, over steel base metal.
6. BHMA 652: Satin chromium plated over nickel, over steel base metal.

2.18 SECURITY FASTENERS

A. Operable only by tools produced by fastener manufacturer or other licensed fabricator for use on specific fastener type. Provide drive-system type, head style, material, and protective coating as required for assembly, installation, and strength, and as follows:

1. Drive-System Type: Pinned Torx-Plus.
2. Fastener Strength: 120,000 psi (827 MPa).
3. Socket Button Head Fasteners:

    a. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).
    b. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.

4. Socket Flat Countersunk Head Fasteners:

    a. Heat-treated alloy steel, ASTM F 835 (ASTM F 835M).

b. Stainless steel, ASTM F 879 (ASTM F 879M), Group 1 CW.

5. Socket Head Cap Fasteners:

a. Heat-treated alloy steel, ASTM A 574 (ASTM A 574M).
b. Stainless steel, ASTM F 837 (ASTM F 837M), Group 1 CW.

6. Protective Coatings for Heat-Treated Alloy Steel:

a. Zinc and clear trivalent chromium where indicated.
b. Zinc phosphate with oil, ASTM F 1137, Grade I, or black oxide unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine detention doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing—in for embedded and built—in anchors to verify actual locations of detention door hardware connections before detention door hardware installation.

C. Inspect built—in and cast—in anchor installations, before installing detention door hardware, to verify that anchor installations comply with requirements. Prepare inspection reports.

1. Remove and replace anchors where inspections indicate that they do not comply with specified requirements. Reinspect after repairs or replacements are made.
2. Perform additional inspections to determine compliance of replaced or additional work.

D. Verify locations of detention door hardware with those indicated on Shop Drawings.

E. Examine roughing-in for electrical power systems to verify actual locations of connections before detention door hardware installation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Detention Doors and Frames: Comply with BHMA A156.115 Series.

1. Surface-Applied Detention Door Hardware: Drill and tap detention doors and frames according to SDI A250.6.

3.3 INSTALLATION

A. Mounting Heights: Mount detention door hardware units at heights indicated in DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."

B. Install each detention door hardware item to comply with Shop Drawings and manufacturer's written instructions. Where cutting and fitting are required to install detention 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. Do not install surface—mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinge Installation:

1. Welding: Where indicated, weld hinges to detention doors and frames with continuous fillet weld around three sides of hinge perimeter.
2. Security Fasteners: Provide socket flat countersunk head machine screws; finish screw heads to match surface of detention hinges. Install into drilled and tapped holes.

D. Install interconnecting wiring and connectors between detention door hardware devices. Terminate device wiring for detention door hardware installed in swinging doors at a plug—type connector located in lock pocket or door frame junction box.

E. Security Fasteners: Install detention door hardware using security fasteners with head style appropriate for installation requirements, strength, and finish of adjacent materials.

F. Surface Mounted Lock Box Installation:

1. Demolition

a. Remove existing lock and strike.

b. Remove existing DPS and disconnect wiring. Route wiring back to the lock pocket for use with the new DPS located in the new lock pocket.

c. All material removed shall remain the property of the owner. Assemble all existing locks removed from doors and palletize for delivery to the owner.

2. Installation

a. Along with new door hinge installation, adjust existing door and frame as needed, and where possible to hold a 1/8” gap at the sides and top.

b. Install lock pocket and strike, plumb, level, square, rigid, aligned and anchored in accordance with the final reviewed and accepted shop drawings and manufacturers product data.

c. Exposed field welds shall be finished smooth, touched up with a rust inhibitive primer, and finish painted as defined above.

d. Primed or painted surfaces which have been scratched or otherwise marred during Installation (including field welding) and/or cleaning, shall be promptly finished smooth, cleaned, treated for maximum paint adhesion, touched up with a rust inhibitive primer comparable and compatible to ship applied primer then finish coated as defined above.

e. Where the gap between the lock pocket and the wall, frame or door is greater than .030 in (Approximately the width of a credit card) the gap shall be filled with pick proof caulk.

3. Final Cleaning and Coordination

a. Doors and hinges shall be adjusted to ensure proper operation and performance with the new lock and lock pocket.

b. Clean exposed frame and door surfaces of all weld smoke, grease, and grime caused by construction after completion of each cell block.

c. Coordinate with SEC for to ensure approved and proper Door Control System operations and functionality in order to achieve a final approved door control system.

3.4 FIELD QUALITY CONTROL

A. Inspect installed products to verify compliance with requirements. Prepare inspection reports and indicate compliance with and deviations from the Contract Documents.

B. Perform the following tests and inspections:

1. After installing electrically powered detention door hardware and after electrical circuitry has been energized, test detention door hardware for compliance with requirements.

a. Test: Operate lock of each door and group of doors in normal remote, normal local, and emergency operating modes. Verify that remote controls operate correct door locks and in correct sequence.

2. Verify that lock bolts engage strikes with required bolt projection.
3. Verify that detention door hardware is installed, connected, and adjusted according to the Contract Documents.
4. Verify that electrical wiring installation complies with manufacturer's submittal and written installation requirements.

C. Detention work will be considered defective if it does not pass tests and inspections.

D. Perform additional inspections to determine compliance of replaced or additional work.

E. Prepare field quality-control certification endorsed by Detention Specialist/Detention Equipment Contractor that states installed products comply with requirements in the Contract Documents.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust and check each operating item of detention door hardware and each detention door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust detention door-control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by detention door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that detention door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain detention door hardware and detention door hardware finishes. Provide training in collaboration with and at same time as, or as otherwise agreed upon by Owner, A/E, and General Contractor, the Security Equipment Contractor’s training of the Door Control System.

3.8 DETENTION DOOR HARDWARE SCHEDULE

A. General: Provide detention door hardware for each detention door to comply with requirements in this Section and with detention door hardware sets indicated below.

3.9 HARDWARE SCHEDULE:

DHW-1 Door 012A

Qty	Item	Model#/Description	Finish	Company
3	Hinges	4-1/2 FM-ICS	US32D	FA
1	Lock	56M-6-CL-24VDC	US32D	FA
1	Cylinder	Paracentric	US26D	FA
1	Outside Pull	No. 2 *Raised pull*	US32D	FA
1	Inside Pull	No. 2 *Raised pull*	US32D	FA
1	Door Stop	420	Black	SF
1	Armor Plate	K1050 3BE DOW X 8”H	US32D	RO
1	Weather Strip	110SA	CL	NGP
1	Threshold	896S MS/LA	AL	NGP
1	Closer	4211T	689	LCN

DHW-2 Door 009A

Qty	Item	Model#/Description	Finish	Company
3	Hinges	4-1/2 FM-ICS	US32D	FA
1	Lock	76-4B	US32D	FA
1	Cylinder	Paracentric	US26D	FA
1	Outside Pull	No. 2 *Raised pull*	US32D	FA
1	Inside Pull	No. 2 *Raised pull*	US32D	FA
1	Door Stop	420	Black	SF
1	Armor Plate	KI 050 3BE DOW X 8”H	US32D	RO
1	Closer	421 1 T	689	LCN

Abbreviation Legend

FA	Folger Adams
HA	Hager
LCN	LCN
NGP	National Guard Products
PE	Pemko
RO	Rockwood
SF	Southern Folger
SS	Southern Steel

END OF SECTION 087163

SECTION 088000 - GLAZING

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. Glass for windows, doors and interior borrowed lites.
2. Glazing sealants and accessories.

B. Related Requirements:

1. Section 085113 “Aluminum Windows.”
2. Section 081113 “Hollow Metal Doors and Frames.”

1.3 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

F. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include

edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1.4 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
   a. Specified Design Wind Loads: As indicated, but not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
   b. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."
   c. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
   d. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or 1 inch, whichever is less.
      1) For insulating glass.
   e. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
2. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:

   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.

b. Solar Heat Gain Coefficient: NFRC 200.
c. Solar Optical Properties: NFRC 300.

1.5 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Samples: For the following products, in the form of 12-inch- square Samples for glass and of 12-inch- long Samples for sealants. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

D. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.

1. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

2. For tempered glass, provide documentation demonstrating that manufacturer of tempered glass meets requirements.

E. Qualification Data: For installers.

F. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

G. Product Test Reports: For each of the following types of glazing products:
1. Insulating glass.
2. Glazing sealants.
3. Glazing gaskets.

H. Warranties: Special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain the following through one source from a single manufacturer for each glass type: clear float glass coated float glass and insulating glass.

C. Source Limitations for Glass Sputter-Coated with Solar-Control Low-E Coatings: Where solar-control low-e coatings of a primary glass manufacturer that has established a certified fabricator

program is specified, obtain sputter-coated solar-control low-e-coated glass in fabricated units from a manufacturer that is certified by coated-glass manufacturer.

D. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

E. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.

1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
2. Glass Testing Agency Qualifications: An independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

F. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

G. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.

H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency or manufacturer acceptable to authorities having jurisdiction.
2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites 9 sq. ft. or less in exposed surface area of one side, provide glazing products that comply with Category I

or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.

I. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA Laminated Division's "Laminated Glass Design Guide" and GANA's "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Sloped Glazing Guidelines."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the following testing and inspecting agency:

1. Insulating Glass Certification Council.
2. Associated Laboratories, Inc.

K. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass

units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of manufacture.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Basis-of-Design Product: The design for each glazing product is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by another manufacturer.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
3. For uncoated glass, comply with requirements for Condition A.
4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.

B. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.

1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated.

3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
4. Sealing System: Dual seal, with primary and secondary sealants as follows:

    a. Manufacturer's standard sealants.

5. Spacer Specifications: Manufacturer's standard spacer material and construction.
6. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:

    a. Spacer Material: Aluminum with powdered metal paint finish in color selected by Architect.
    b. Desiccant: Molecular sieve or silica gel, or blend of both.
    c. Corner Construction: Manufacturer's standard corner construction.

2.3 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Single-Component Neutral- and Basic-Curing Silicone Glazing Sealants GS-1:

    a. Available Products:
        1) Pecora 896

    b. Type and Grade: S (single component) and NS (nonsag).
    c. Class: 100/50.
    d. VOC: 100 g/L
    e. Use Related to Exposure: NT (nontraffic).
    f. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.
    g. Applications: Manufacturers standard in Aluminum Windows and Aluminum Entrances.

2.4 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.
2. EPDM, ASTM C 864.
3. Silicone, ASTM C 1115.
4. Thermoplastic polyolefin rubber, ASTM C 1115.
5. Any material indicated above.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:

1. Neoprene.
2. EPDM.
3. Silicone.
4. Thermoplastic polyolefin rubber.
5. Any material indicated above.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 GLASS SCHEDULE

A. Insulating Glass IG-1: Where glass of this designation is indicated, provide coated insulating-glass units complying with the following:

1. Products: Available products include the following:

    a. Guardian SN 68
    b. PPG Solarban 60
    c. Viracon Solar Screen 2000 VE 1-2M

2. Overall Unit Thickness and Thickness of Each Lite: 1”, ¼”

3. Interspace Content: Air

4. Indoor Lite

    a. Class 1 Clear

5. Outdoor Lite

a. Class 2 coated Low E, heat absorbing

6. Visible Light Transmittance: 70%

7. Winter Nighttime U-Value: .28

8. Summer Daytime U-Value: .30

9. Solar Heat Gain Coefficient: .40

B. Insulating Glass IG-2: Same as IG-1 except tempered glass on inner and outer lites for use in locations requiring safety glazing.

a. Guardian
b. PPG
c. Viracon

C. Insulating Glass IG-3: Same as IG-1 except frosted glass on inner lite for use in locations requiring decorative appearance.

a. Guardian “Satin Deco”
b. PPG
c. Viracon “Velour Acid Etched Glass”

B. Interior Heat Strengthened Glass G-1: For glazing in interior storefront not required to be safety glass.

C. Interior Tempered Glass G-2: For glazing in doors, sidelites and other interior applications required to be safety glass.

END OF SECTION 08800

SECTION 092216 - NON-STRUCTURAL METAL 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. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.

C. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.033 inch.
b. Depth: 3-5/8 inches.

D. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
2) Steel Network Inc. (The)
3) Superior Metal Trim; Superior Flex Track System (SFT).

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.033 inch.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch.
2. Depth: 1-1/2 inches.

H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: hat shaped.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 3/4 inch.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:
1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.
b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Lafarge North America Inc.
   b. National Gypsum Company.
   c. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 1/2 inch.

2. Long Edges: Tapered.

D. Foil-Backed Type:

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation, through-penetration (impact resistance), and abrasion than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.
h. Other as indicated on drawings.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Fry Reglet Corp.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose] compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating 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. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 22 percent.

E. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."

1. Provide sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

D. Form control and expansion joints with space between edges of adjoining gypsum panels.

E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Ceiling Type: Ceiling surfaces.
2. Foil-Backed Type: As indicated on Drawings or where required for vapor barrier.
3. Abuse-Resistant Type: Vertical surfaces unless indicated otherwise.
4. Moisture- and Mold-Resistant Type: At Toilet Rooms and Locker Room Shower Ceilings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.

2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use where indicated.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Where indicated on Drawings.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

    a. Primer and its application to surfaces are specified in other Division 9 Sections.

5. Level 5: Where indicated on Drawings.

    a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.6 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 – CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Metal edge strips.

B. Related Requirements:

1. Section 092900 “Gypsum Board” for tile backing panel requirements

1.2 ACTION SUBMITTALS

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

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds in 6-inch (150-mm) lengths.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Build mockup of each type of wall tile installation.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. Tile Types: Provide tile of types, sizes, patterns, and colors as indicated on the Drawings and Schedules.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Crossville, Inc.
   b. Daltile.
   c. Olympia Tile

2. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of flat tile. Provide shapes as follows from manufacturer's standard shapes:

   a. Base cove
   b. Base Cap
   c. Wainscot Cap
   d. External Corners
   e. Internal Corners
   f. Tapered Transition Tile

3. Grout Color: As selected by Architect from Manufacturer's full range

C. Color: Artic White (Subway) Basis of Design: Dal Tile Rittenhouse Square

D. Size: 3"x6"

E. Pattern: Bond

F. Size: As indicated on drawings.

2.2 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of [10] [12] per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2.3 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ARDEX GmbH.
b. Laticrete International, Inc.
c. MAPEI Corporation.
d. National Applied Construction Products, Inc.
e. TEC; H.B. Fuller Construction Products Inc.

2.4 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated.

B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch (0.203-mm) nominal thickness.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Schluter Systems L.P.; KERDI.

2.5 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

B. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Laticrete International, Inc.
b. MAPEI Corporation.
c. Summitville Tiles, Inc.

2. For wall applications, provide nonsagging mortar.

C. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following

    a. Laticrete International, Inc.
    b. MAPEI Corporation.
    c. Summitville Tiles, Inc.

2. Prepackaged, dry-mortar mix to which only water must be added.
3. For wall applications, provide nonsagging mortar.

2.6 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Laticrete International, Inc.
    b. MAPEI Corporation.
    c. Summitville Tiles, Inc.

C. Polymer-Modified Tile Grout: ANSI A118.7.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Laticrete International, Inc.
    b. MAPEI Corporation.
    c. Summitville Tiles, Inc.

2. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.
3. Polymer Type: Liquid-latex form for addition to prepackaged dry-grout mix.

2.7 ELASTOMERIC SEALANTS

A. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements,provide one of the following:

    a. DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant.
    b. Dow Corning Corporation; Dow Corning 786.
    c. GE Silicones, a division of GE Specialty Materials; Sanitary 1700.
    d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
    e. Tremco Incorporated; Tremsil 600 White.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, half-hard brass exposed-edge material.

C. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bonsal American, an Oldcastle company; Grout Sealer.
b. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout, 004, Keraseal Penetrating Sealer for Unglazed Grout and Tile.
c. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

A. Comply Paver, quarry, and mosaic floor tile over concrete floor, general areas – Thin-set latex Portland cement mortar TCA-F113.

B. Ceramic Wall tile on gypsum wallboard or cementitious backer units – organic adhesive TCA W223.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Paver Tile: 1/4 inch (6.35 mm).
3. Glazed Wall Tile: 1/16 inch (1.6 mm).
4. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

L. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

M. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

N. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

O. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

3.4 CLEANING AND PROTECTION

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.
2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer’s printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbounded, and otherwise defective tile work.

C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Project completion.

1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage and wear.
2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which suspension systems will be attached.
3. Size and location of initial access modules for acoustical panels.
4. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in 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. Acoustical Ceiling Panels: Full-size panels equal to 4 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.
4. Impact Clips: Equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

C. 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.

2.2 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

E. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

F. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS – ACT-1 (Office Areas)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong ULTIMA Square Lay-in Item # 1913 or comparable product by one of the following:
1. CertainTeed Corp.
2. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with acoustically transparent water repellent membrane.
2. Pattern: E (lightly textured).

C. Color: White.

D. LR: Not less than 0.90.

E. NRC: Not less than 0.70.

F. CAC: Not less than 35.

G. Edge/Joint Detail: Square.

H. Thickness: 3/4 inch.

I. Modular Size: 24 by 48 inches.

J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

F. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch- thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.

2.5 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude XL 15/16” Exposed Tee System or a comparable product by one of the following:

1. USG Interiors, Inc.

2. BPB, USA.

B. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, G30 coating designation.

1. Structural Classification: ASTM 635.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Moldings or a comparable product by one of the following:

1. Fry Reglet Corporation.
2. USG Interiors, Inc.

B. Metal or Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips.

2.7 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical Sealant for Concealed Joints:

a. OSI Sealants, Inc.; Pro-Series SC-175 Rubber Base Sound Sealant.
b. Pecora Corporation; BA-98.
c. Tremco, Inc.; Tremco Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Compliance of seismic design.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.
3. Resilient stair accessories.

1.2 ACTION SUBMITTALS

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

B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches (300 mm) long, of each resilient product color, texture, and pattern required.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:

    a. Armstrong World Industries, Inc.
    b. Johnsonite.
    c. Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (rubber, vulcanized thermoset)
2. Manufacturing Method: Group I (solid, homogeneous).
3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm) unless noted otherwise on Drawings.

E. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: As selected by Architect from manufacturer's full range.

I. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

3.3 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

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. Luxury Vinyl floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

   1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

C. Samples for Initial Selection: For each type of floor tile indicated.

D. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C) , in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 LUXURY VINYL COMPOSITION FLOOR TILE <**LVT-1**>

A. Basis of Design Product: Subject to compliance with requirements, provide Shaw Contract Group products or a comparable product from one of the following:

1. Shaw
2. Mohawk
3. Mannington Commercial.

B. Style: 1020V PARAGON 7" PLUS

C. Collection: Floorte Pro Series

D. Wearing Surface: Smooth.

E. Thickness: 5.5 mm.

F. Size: 7 by 48 inches

G. Colors: 07047 RIPPED PINE

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles with grain running in one direction.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 097200 - WALL COVERINGS

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. Decorative Fiberglass Reinforced Wall Panels & Base.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement seams, connectors, edges, corners, and termination points.

C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 12-inch long in size.

1. Wall-Covering Sample: From same production run to be used for the Work, with specified applied

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

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

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for installation.

1. Build mockups for each type of wall covering on each substrate required. Comply with requirements in ASTM F 1141 for appearance shading characteristics.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 FIELD CONDITIONS

A. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

B. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Basis of Design: Standard FRP Panels by Marlite; 202 Harger Street, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com www.marlite.com. Units shall have the following characteristics or comparable product by one of the following:
   a. Crane Composites.
   b. Panolam Surface Systems.

2.2 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
   1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
   2. Dimensions:
      a. Thickness – 0.090 “ (2.29mm) nominal
      b. Width - 4'-0” (1.22m) nominal

c. Length – 10’-0” (3.0m) nominal

3. Tolerance:
   a. Length and Width: +/-1/8 “ (3.175mm)
   b. Square - Not to exceed 1/8 “ for 8 foot (2.4m) panels or 5/32 “ (3.96mm) for 10 foot (2.4m) panels

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
1. Flexural Strength - 1.0 x 10^4 psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
2. Flexural Modulus - 3.1 x 10^5 psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
3. Tensile Strength - 7.0 x 10^3 psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
4. Tensile Modulus - 1.6 x 10^5 psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
5. Water Absorption - 0.72% per ASTM D 570.
6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

D. Front Finish

a. Color:
   1) Marlite Standard FRP “145 Silver”
b. Surface: Smooth.
c. Fire Rating: Class C (III) Fire Rating.
d. Size: 4’x9’ Panels

2.3 BASE

A. Marlite 4” Base Molding for 0.090 thick FRP Panels
1. Color: Black.
2. Profiles:
   a. M 612 FRP Base Molding, 10’ length
   b. M 651 Inside Corner
   c. M 660 Outside Corner
   d. M 620 LH End Cap
   e. M 625 RH End Cap

2.4 MOLDINGS

A. PVC Trim: Thin-wall semi-rigid extruded PVC.
1. M 350 Inside Corner,10’ length
2. M 360 Outside Corner,10’ length
3. M 365 Division, 10’ length
4. M 370 Edge, 10’ length
5. Color: Silver

B. Outside Corner Guard:
   1. F 560SS Stainless Corner Guard, 10’ length
   2. Finish: #4 brushed satin

2.5 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.
   1. Match panel colors.
   2. Length to suit project conditions.

B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
   1. Marlite C-551 FRP Adhesive - Water- resistant, non-flammable adhesive.
   2. Marlite C-375 Construction Adhesive - Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
   3. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.

C. Sealant:
   1. Marlite Brand MS-250 Clear Silicone Sealant.
   2. Marlite Brand MS-251 White Silicone Sealant.
   3. Marlite Brand - Color Match Sealant .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
   1. Verify that stud spacing does not exceed 24” (61cm) on-center.

B. Repair defects prior to installation.
   1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.3 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (3 mm) clearance for every 8 foot (2.4m) of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
   2. Pre-drill fastener holes 1/8” (3mm) oversize with high speed drill bit.
      a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
      b. Space at in field in rows 16’ (40.64cm) on center, with fasteners spaced at 12” (30.48 cm) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
   1. Install panels with manufacturer's recommended gap for panel field and corner joints.
      a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
      b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
   1. All moldings must provide for a minimum 1/8 “ (3mm) of panel expansion at joints and edges, to insure proper installation.
   2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099123 – INTERIOR AND EXTERIOR PAINTING

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 surface preparation and the application of paint systems on interior substrates.

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Cast iron.
5. Galvanized metal.
6. Aluminum (not anodized or otherwise coated).
7. Wood.
8. Gypsum board.

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.
3. VOC content.

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Owner will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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. Benjamin Moore & Co.
2. M.A.B. Paints.
3. Sherwin-Williams Company (The).

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction.

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

D. Low-Emitting Materials: Interior paints and coatings 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. Colors: As indicated in a color schedule.

2.3 BLOCK FILLERS

A. Block Filler, Latex, Interior/Exterior: MPI #4.
   1. Sherwin Williams PrepRite Block Filler

2.4 PRIMERS/SEALERS

A. Primer Sealer, Latex, Interior: MPI #50.
   1. Sherwin Williams

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

2.5 METAL PRIMERS

A. Rust-Inhibitive Primer (Water Based): MPI #107.

   1. VOC Content: <100 g/L.

B. Waterborne Galvanized-Metal Primer: MPI #134.

   1. VOC Content: <100 g/L.

2.6 WOOD PRIMERS

A. Interior Latex-Based Wood Primer:

   1. VOC Content: 41g/L

2.7 LATEX PAINTS

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).

   1. VOC Content: 0g/L

B. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

   1. VOC Content: 0g/L

C. Interior Latex (Satin): MPI #43 (Gloss Level 4).

1. VOC Content: 0g/L

D. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

1. VOC Content: 0g/L

E. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

1. VOC Content: 0g/L

F. High Performance Laytex Gloss and Semi-Gloss

1. VOC Content: 200 g/L

2.8 PRECATALYZED EPOXY

A. Waterbased Epoxy

1. VOC Content: 141 g/L

2.9 FLOOR COATINGS

A. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.

1. VOC Content: .

B. Interior/Exterior Latex Floor (Low Gloss): MPI #60 (maximum Gloss Level 3).

1. VOC Content: 100g/L.

2.10 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Plaster Substrates: Verify that plaster is fully cured.

E. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

F. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

G. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove loose surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR AND EXTERIOR PAINTING SCHEDULE

A. Basis of Design Manufacturer: Sherwin Williams. Products as listed below.

B. CMU Substrates:
1. Interior Walls

a. Prime Coat: SW PrepRite Block Filler, 50 g/l. MPI #4
b. Intermediate Coat: SW ProMar 200 High performance Eg-Shel, 0g/l.
c. Topcoat: Interior latex SW ProMar 200 High performance Eg-Shel, 0g/l.

2. Exterior CMU wall- clear sealer Loxon Water repellant 7% siloxane

C. Concrete Substrates
1. Concrete Floors –Garage Area

a. Prime Coat: SW ArmorSeal Tread-Plex WB Acrylic Coating, 100 g/l.
b. Topcoat: SW ArmorSeal Tread-Plex WB Acrylic Coating, 100 g/l.

D. Steel Substrates:
1. Interior Doors and Frames.

a. Prime Coat: SW ProIndustrial Pro-Cryl Universal Primer, 100 g/l MPI #107
b. Intermediate Coat: SW ProIndustrial High performance Acrylic Semi-Gloss, 0 g/l.
c. Topcoat: SW ProIndustrial High performance Acrylic Semi-Gloss, 0 g/l.

2. Exterior Doors and Frames.

a. Prime Coat: SW ProIndustrial Pro-Cryl Universal Primer, 100 g/l
b. Intermediate Coat: SW ProIndustrial High performance Acrylic Semi-Gloss, 0 g/l.
c. Topcoat: SW ProIndustrial High performance Acrylic Semi-Gloss, 0 g/l.

E. Galvanized-Metal Substrates:
1. Interior:

a. Prime Coat: SW ProIndustrial Pro-Cryl Universal Primer,
b. Intermediate Coat: SW Sher-Cryl HP Semi-Gloss,
c. Topcoat: SW Sher- Cryl HP Semi-Gloss,

2. Exterior:

a. Prime Coat: SW ProIndustrial Pro-Cryl Universal Primer,
b. Intermediate Coat: SW Sher- Cryl HP Semi-Gloss,
c. Topcoat: SW Sher-Cryl HP Semi-Gloss,

F. Gypsum Board Substrates:

1. Acrylic System: Office Areas: Eggshell

a. Prime Coat: SW ProMar 200 Zero Primer, 0 g/l
b. Intermediate Coat: SW ProMar 200 High performance Eg-Shel, 0 g/l
c. Topcoat: SW ProMar 200 High performance Eg-Shel, 0 g/l

2. Epoxy: Toilet/Locker Room Areas: Eggshell

a. Prime Coat: SW ProMar 200 Zero Primer, 0 g/l
b. Intermediate Coat: SW ProIndustrial Pre-Catalyzed Water Based Epoxy, 141 g/l
c. Topcoat: SW ProIndustrial Pre-Catalyzed Water Based Epoxy, 141 g/l

END OF SECTION 099123

SECTION 099659

SEAMLESS FLOOR SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes the following resinous wall, ceiling, and flooring systems:

1. SES-1: Seamless Reinforced Epoxy System: integrated system for floors, walls and ceilings consisting of 100% solids accelerated aliphatic amine cured epoxy with Kevlar® and chopped stranded fiberglass reinforcement, and an integrated anti-MRSA topcoat system or approved equal.

1.02 REFERENCE STANDARDS

A. ASTM E 1907 Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings.

B. ASTM D 4263 Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

C. ASTM F 1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Sub-floor by Using Anhydrous Calcium Chloride.

D. ASTM F 2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes.

E. ASTM D 4501 Standard Test Method for Shear Strength of Adhesive Bonds Between Rigid Substrates by the Block-Shear Method.

F. ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

G. ASTM C 579 Standard Test Methods for Compressive Strength of Chemical- Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

H. ICRI No. 03732 Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays, CSP 1-9.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Prior to the installation of the seamless system, meeting shall be held at the project site with the manufacturer’s representative, the installer, the engineer/architect, and the Owner’s representative. Record discussions and furnish a copy to each participant. Topics to be discussed shall include, but not be limited to:

1. Planned start and completion timing for each mobilization.

2. Safety procedures.
3. Coordination of other trades in area.
4. Existing and new slab conditions.
5. Slab testing results.
6. Existing wall substrate conditions.
7. Surface preparation.
8. Required room temperatures.
9. Ventilation.
10. Step by step installation procedures.
11. Curing time and methods.
12. Protection of completed work.
13. Review of performance requirements including chemical abuse, effluent temperature, type, size, and weights of vehicular and static loads.

1.04 SUBMITTALS

A. Only manufacturers whose proposed system meets all generic system descriptions in composition, thickness, number of layers, etc. shall be considered. All perspective manufacturers must submit their complete system including a step by step description of system components, product data sheets, level of thickness applied, application method, etc. for review to insure that the system meets the minimum standards of basis of design system(s) specified. Manufacturers' proposed systems must be received for review 10 days prior to bid date and must be preapproved prior to bid date to be acceptable. No systems will be reviewed or accepted after bid date.

B. Product Data: For each product indicated, include manufacturer's technical data, application instructions, and recommendations for each product component.

C. Shop Drawings:

1. Provide enlarged details indication terminations at walls, door frames, pits, curbing, etc.

D. Samples: For each resinous system required, provide, when requested, a sample applied to a rigid backing, minimum size 3" x 3."

E. Installer Certificates: Signed by manufacturer, certifying that installer complies with specified requirements. Installer certificate must be included in contractor's bid proposal. Failure to include the signed certification from the manufacturer with bid proposal for specified work shall disqualify bid.

F. References: Manufacturer shall submit a list of 10 projects of similar size and complexity as this project, including Owner's names and contact phone numbers. **Projects must be prison projects where spray applied Kevlar and Fiberglass reinforced epoxy systems were installed as described in this specification section.**

When renovation of existing finishes is involved contractor must provide proof that their experience involves full removal of existing finishes and setting beds, re-sloping of flooring per ADA requirements and installing spray applied Kevlar and Fiberglass stranded epoxy system with integrated flooring and cove base. Project list shall be submitted with contractor's bid proposal. No contractor shall be awarded this scope of work without first proving they have the specified experience with new construction and when applicable installation of the same for renovation projects as specified. Failure to include project list with current names and references in bid proposal shall be disqualified.

G. Warranty: Manufacturer alone shall provide a specimen copy of warranty included in bid proposal in compliance with requirement as specified in Section 1.09. Failure to include Manufacturer's specimen warranty proving that the warranty is in compliance with bid document requirements will disqualify contractor's bid.

H. Manufacturer's Field Services: Only manufacturers who are willing to provide the specified field services and whose products meet or exceed the basis of design systems shall be considered for approval. Contractor's bid proposal must include letter of manufacturer's intent to comply with the required field services as specified in Section 1.05 E 1-4.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is experienced in applying the resinous system(s) specified herein.

B. Certifications and Warranty:

1. All bids must include with the price of their work a letter of training certification from the manufacturer stating that the installer is approved and meets the specified experience requirements to apply the products specified in this section.

2. All bids must include a copy of the manufacturer's warranty that covers the 5-year material and labor replacement for any project failures due to product performance or its improper installation as further clarified in section 1.09.

Note: Failure to include the above submittals with installer's bid proposal will result in the bid being rejected.

C. Acceptable manufacturers must include the following in all bid proposals:

1. Written description of installer's experience with specified material over the last 5 years, including job sizes and complexity.

2. Warranty sample letter where manufacturer alone accepts full responsibility for contractor's workmanship and the manufacturer's installed products' performance for the warranty period of 5 years.

3. Manufacturer's letter agreeing to perform the manufacturer's field services as specified is section 1.05 E. 1-4.

D. Source Limitations: Obtain all resinous flooring materials, including waterproofing membranes, grouts, resins, curing agents, grout coats, aggregates, topcoats, patching and fill material, joint sealants, and repair materials from a single Manufacturer.

E. Manufacturer Field Services: The installer of the coating system shall contact the material manufacturer during the bidding phase of the project and shall include in the cost of his work, the cost of a manufacturer's field engineering person to be present throughout the duration of all aspects of the work specified in this section as follows:

1. Material Manufacturer shall be responsible for the review of the project conditions that may impact product performance before product installation, including but not limited to project climate, acceptable temperature of substrate and air, acceptable humidity levels of air, acceptable moisture content of substrates to be coated, surface preparation, and all other conditions that are necessary for optimum product performance. The manufacturer's field engineer shall document and verify that all conditions are acceptable prior to commencement of work.

2. The manufacturer's field representative shall submit through the Contractor written approvals of the proposed coating system including manufacturer's recommended applicator, manufacturer's recommended application procedures, and manufacturer's recommended surface preparation.

3. The manufacturer is solely liable for any warranty claims resulting from product failure, whether caused by defective product or improper installation for a period of 5 years. See warranty section: 1.09 for clarification.

4. The materials manufacturer's representative must be present on site for the pre-installation site conditions evaluation, for the duration of the surface preparation and for all phases of the installation of the specified resinous coating system. Installer's bid shall include the cost of the manufacturer's field services as specified above.

1.06 MOCKUP

A. Apply mockups, when required to verify selections made from sample materials and to set quality standards for materials and execution. The entity who approves the mockups and who performs the final inspection shall be the same.

1. Approved mockups may become part of completed Work if undisturbed at the time of Substantial Completion.

2. Apply full thickness mockups on a minimum of a 4' x 4' section of flooring integrated with a 4' x 4' section of wall selected by the Architect/Engineer.

3. If a cove base is to be included on the project, mockup shall include same.

4. Manufacturer must verify prep before any epoxy is installed.

Note: the cost of mockups when required shall be a separate line item in the bid proposal.

1.07 DELIVERY, STORAGE, & HANDLING

A. Materials shall be delivered in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials in a location to prevent deleterious effects from sunlight, moisture, excessive heat, or cold.

C. Storage of materials shall comply with all fire and safety regulations.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application including the following:

1. Maintain ambient air temperature between 65°F and 85°F.

2. Concrete substrate shall be properly cured for a minimum of 28 days prior to installing the specified system.

B. General Condition of Substrates: Prepare and clean substrates in accordance with manufacturer’s written instructions for substrate indicated. Provide clean, dry, and neutral pH substrate for resinous floor/wall application.

C. Concrete Floors: New Construction

1. Allow all new concrete to dry a minimum of 28 days.

2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

3. Profile sound surfaces for proper adhesion. For thin-film coatings and floors under 1,000 sf or with limited access: Diamond grind to expose concrete matrix and profile concrete floor surfaces to a classification of ICRI CSP2. For all other floor systems: Shot blast all concrete floor surfaces to a classification of ICRI CSP5.

D. Concrete Floors: Existing

1. Floor tile, caulk, mastics, terrazzo basins and other floor finishes shall be completely removed down to sound substrate. In the removal process contractor shall use proper demolition procedures that minimize damage to the substrate, avoiding gouging and creating a non-uniform substrate.

2. Properly clean/sanitize all surfaces to eliminate any surface contaminants.

3. Pre-patch any imperfections, recessed areas, cracks, etc. with manufacturer's recommended 100% solids epoxy patching material to provide an even and uniform

surface. All patching shall be struck smooth and be flush with the surface of the substrate.

4. Profile sound surfaces for proper adhesion. Diamond grind to expose concrete matrix and profile concrete floor surfaces to a classification of ICRI CSP2. For all other floor systems: Shot blast all concrete floor surfaces to a classification of ICRI CSP5.

5. Visually inspect shot blasted or grinded surfaces to make sure that profiled surfaces are free of contaminants. Areas that are stained or visually contaminated shall be treated with a 15% by volume solution of aqueous tri-sodium phosphate (TSP) or other de-greasing agent as recommended by the coatings manufacturer. Rinse and dry all floor surfaces scheduled to receive high-performance floor system finish prior to commencement of resinous flooring application.

6. Remove and legally dispose of all debris and contaminants produced by the demolition and surface preparation process. Steel media resulting from the shot blasted floor slab surface shall be removed from cracks, slab edges, construction joints, and corners by magnets, magnetic broom, air blast, vacuum, or stiff bristle broom.

E. Concrete Walls and Ceilings:

1. Mechanically abrade surfaces to achieve an ICRI CSP2 anchor profile for coating and to open up the skin of precast or poured in place concrete to expose honeycombs and air entrapment pockets.

2. Precast and poured in place concrete shall have high edges ground down flush with adjacent areas prior to installing coating.

3. Pre-patch any recessed areas, voids, cracks, etc. with manufacturer's recommended patching material to provide a nominally uniform surface. All patching shall be struck smooth and be flush with the surface of the substrate. Note: New Precast and poured in place concrete require sacking all voids with manufacturer’s recommending filler that is compatible with specified coating system to tightly fill voids flush prior to installing the specified coating system.

F. Existing Walls: Tile, Glazed Block, Painted Concrete, Painted Block

1. Remove all tile, mastics and other surface contaminants down to sound substrate.

2. All glazed block shall have the glazed surface completely ground off prior to coating.

3. Previously painted/coated surfaces shall be fully removed down to sound substrate.

G. Cement Board: (New Construction)

1. Cement boards receiving the specified coating system shall be installed by others with smooth side exposed.
2. Pre-patch any imperfections, air pockets, etc. with manufacturer's recommend patching compound compatible with systems to be installed. All patching shall be struck smooth and be flush with the surface of the substrate.
3. Joint filling and taping of joints shall be done by installer of epoxy coating system specified herein with 100% solids thixotropic epoxy compound and reinforced mesh tape per manufacturer's recommendations.
4. Remove any finish in excess of Level 3.

H. Lighting: Proper lighting is required for installation. When possible, lighting shall simulate permanent lighting conditions during resinous floor/wall application.

I. Close spaces to traffic during resinous coatings application and for not less than 48 hours after application, unless manufacturer recommends a longer period.

J. Airborne contamination: Resinous systems shall not be applied in areas where dust or other airborne particulate matter is being generated.

1.09 WARRANTY

A. Manufacturer alone shall furnish a single, written warranty covering 100% of the material and labor costs protecting the Owner from delamination and product failure caused by defective product or defective installation for a period of 5 years from date of installation. Joint warranties between manufacturer and installer not accepted.

1. Issuance of warranty shall be a condition contingent on the receipt of final payment to the Installer.
2. Extent of warranty shall be limited to the repair or replacement of defective surfaces at no cost to the Owner including both material and installation costs associated with any repairs or replacement of defective product or defective installation. The warranty shall not include any remedy for defects caused by abuse, improper maintenance, change of use or operation, moisture migration from the back side of coating system or by normal wear, tear and usage or structural movement of building structure.

PART 2 - **PRODUCTS**

2.01 MANUFACTURERS

A. Manufacturer:

1. Prime Coat Coating Systems, 1949 Swanson Ct. Gurnee, IL info@primecoat.com; tel: 847-362-5111, or approved equal.
2. It is the intent of this project to use Prime Coat Coating System. Any alternates will have to be proven to be equal in composition, number of coats, thickness, performance,

B. Pre-approval is required by architect for all acceptable seamless reinforced shower systems. Only products which are equal to or superior to the specified system in installed thickness, chemistry, composition, reinforcement components and product performance criteria shall be considered.

C. All manufacturers must meet requirements specified, including all manufacturers' warranties and manufacturers' field service responsibilities as listed in section 1.05 and 1.09. Manufacturers specified that do not comply with the specified manufacturer's responsibilities will be rejected from bidding. It is solely the manufacturer's responsibility to furnish proper documentation of their intent to comply with specified requirements and to furnish this documentation to any contractors bidding their materials prior to bid date.

2.02 SYSTEMS

A. SES-1: Seamless Epoxy System for Showers; an integrated system for floors, walls and ceilings consisting of 100% solids accelerated aliphatic amine cured epoxy with chopped strand fiberglass and Kevlar® reinforcement, and an integrated Anti-MRSA Glaze topcoat system.

1. Basis of Design: System Characteristics/Performance Requirements:
    a. Color and Pattern: As selected by Owner from manufacturer's full range.
    b. Wearing Floor Surface: Textured for slip-resistance per Owner selection from manufacturer's full range.
    c. Cove Base: 2-inch Cant-styled.
    d. System Thickness: Walls: 60 mils minimum. Floors: 1/8th inch minimum.
    e. VOC's: in compliance with EQ 4.2, less than 100 g/l.
    f. Product Composition: Wall Systems must be spray applied 100% solids with Fiberglass and Kevlar strands premixed into both the Part A and Part B epoxy components. Must contain fiberglass strands sufficient enough to form a reinforced matrix/web within the resin providing increased tensile strength and impact resistance and high build characteristics as specified.
    g. Compressive Strength Minimum: 11,700 p.s.i. (ASTM D-695)
    h. Tensile Strength Minimum: 3,900 p.s.i. (ASTM D-638)
    i. Hardness minimum: 83-88 (ASTM D-2240/Shore D Durometer)
    j. Abrasion Resistance Minimum: 0.03 gm/1000 revolutions (ASTM D-4060 Taber Abrader.)
    k. High or Low Solids solvent based and all water-based systems excluded.
    l. Mat-layup systems excluded.
    m. Roller applied systems excluded.
    n. Trowel applied systems excluded.
    o. Aggregate reinforced wall systems excluded.

p. Integrated anti-MRSA pathogen protection achieving a 99.9 reduction of micro-organisms as tested per **JIS Z 2801** (Japanese Industrial Standard Committee) to assess performance of anti-microbial surfaces.

4. System Components: Manufacturer's standard components which are compatible with each other as follows:

a. Moisture Mitigation Primer: (Required on slab on grade surfaces that are subject to moisture transmission from ground water)
   1) Product type and system as recommended by the manufacturer of the Seamless Shower System as specified.

b. Flexible Membrane: (required on elevated floor surfaces that are above occupied spaces)
   1) Resin: 100% solids plural component flexible epoxy
   2) Name: PC 620 Elastocoat
   3) Application Method: brush and roller applied
   4) Installed thickness: 30 mils minimum.
   5) Number of coats: 1

c. Sloping Material
   1) Resin: 100% solids plural component with aggregate
   2) Name: PC 310K
   3) Aggregate: Suitable for troweling to provide slope.
   4) Rate of Slope: ¼ inch per foot

d. Cove Base:
   1) Resin: 100% solids plural component.
   2) Name: PC 310K
   3) Aggregate: Suitable to form trowel grade epoxy mortar.
   4) Application Method: Trowel applied
   5) Type: Cant Cove
   6) Size: 2 inches

e. Floor Base Coat:
   1) Resin: 100% solids plural component Bisphenol A epoxy with broadcasting medium
   2) Application method: Apply neat resin and broadcast to rejection.
   3) Minimum installed thickness of neat resin: 20 mils.
   4) Number of coats: 1

f. Primer/Block Filler: (for walls and ceilings)
   1) Resin: 100% solids penetrating epoxy primer/filler.
   2) Name: PC 630 Gelcoat
   3) Application method: spray, roller, or brush.
   4) Minimum installed thickness: 8-10 mils over concrete and non-porous surfaces; 12-16 mils over CMU and other porous surfaces.
   5) Number of coats: 1

g. Kevlar® and Fiberglass Reinforced Spray Applied Body Coat: applied to all surfaces, ceilings, walls, and flooring/cove base
   1) Resin: 100% solids plural component factory filled Kevlar® and fiberglass stranded reinforced epoxy
   2) Name: PC 200 Fibercoat

3) Application method: 45:1 air-powered airless spray w/gravity-fed hopper
4) Reinforcement: Kevlar® and chopped stranded fiberglass factory filled in both resin and hardener components sufficient to form a matrix of spray applied reinforcement.
5) Minimum Installed thickness: 45 mils
6) Number of coats: 1

h. Top Coat: applied to all surfaces, ceilings, walls, flooring and cove base
1) Resin: 100% solids Bisphenol A chemically resistant plural component epoxy with integrated anti-MRSA pathogen protection
2) Name: PC 400W Glazecoat
3) Application method: brush, roller, or spray
4) Minimum installed thickness: 8 mils
5) Anti-MRSA: Integrated into topcoat
6) Type: pigmented
7) Floor Finish only: to meet ADA requirements by broadcasting non-pulverizing aggregate into floor topcoat to achieve proper slip resistant texture.

5. General Performance Requirements:

a. Wall and flooring components shall form a monolithic reinforced coating system that forms a continuous reinforced barrier joining ceilings, walls and flooring surfaces with specified coating system without breaks in material including at interfaces of inside and outside corners and interfaces between walls and ceilings and between walls and floors.

2.03 ACCESSORY MATERIALS

A. Patching and Fill Material: Resinous product of resinous flooring manufacturer.

B. Joint Sealants: Formulated by resinous flooring manufacturer for type of service and joint condition indicated.

PART 3 - **EXECUTION**

3.01 EXAMINATION

A. Verification: Verify that all substrate and environmental conditions are in compliance with requirements discussed during Pre-installation conference.

B. Mandatory Testing of Floor Slabs:

1. Prior to the installation of flooring, it is mandatory that all surfaces are tested for moisture content, pH, and alkalinity levels that would be detrimental to the adhesion of coating materials. For tests to be accurate, temperatures and humidity levels should be stabilized for a minimum of 72 hours. NOTE: TESTING PERFORMED BY ANY METHOD IN UNCONDITIONED SPACES WILL NOT YIELD CONSISTENT RESULTS. Tests below must be completed in accordance with documented Test Methods:

a. Relative Humidity [in situ] Testing per ASTM F 2170

b. Others as required by manufacturer or unique job conditions. If additional testing is required, additional costs may be incurred by owner.

2. Do not proceed with installation if moisture levels exceed 5% or 3 lbs. per 1,000 sf per 24 hours or if ambient temperature is less than 5°F above dew point unless approved by material manufacturer.

C. Testing Activities During Resinous Coating Application

1. Material Sampling: Owner's representative may at any time and any number of times during resinous coating application require the manufacturer to test the material to be in compliance with requirements.

a. Material samples will be taken, identified, sealed, and certified in presence of Installer.

b. Testing agency will test samples for compliance with requirements at the cost to the owner, using applicable referenced testing procedures in addition to testing procedures listed in manufacturer's product data.

2. If test results show applied materials do not comply with specified requirements, Installer shall correct all deficiencies of coating system in a method and manner acceptable to the manufacturer's recommendations.

3.02 PREPARATION

A. General: Prepare and clean substrates in accordance with manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral pH substrate for resinous floor/wall application.

B. Concrete Floors: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring. Floor slabs shall be prepared as follows:

1. Mechanically remove all finishes, mastics, adhesives, and other compounds down to sound substrate. Demolition shall be in accordance with manufacturer's recommendations and written procedures. (Note: If during the demolition a setting bed/underlayment is found beneath the existing flooring materials complete removal of setting bed down to sound substrate is required. Manufacture to then provide epoxy mortar sloping material to replace the setting bed material and to provide proper sloping to drain at a rate of ¼ inch per foot.)

2. Profile sound surfaces for proper adhesion according to manufacturer's requirements to achieve anchor profile for long term adhesion. Manufacturer is responsible for install to prepare and profile the substrate to warrant the bond of the installed coating systems.

3. Visually inspect prepared surfaces to make sure that profiled surfaces are free of contaminants. Areas that are stained or visually contaminated shall be treated with a 15% by volume solution of aqueous tri-sodium phosphate (TSP) or other de-greasing agent as recommended by the coatings manufacturer. Rinse and dry all floor surfaces scheduled to receive high

performance floor system finish prior to commencement of resinous flooring application.

4. Remove and legally dispose of all debris and contaminants produced by the demolition and surface preparation process. Steel media resulting from the shot blasted floor slab surface shall be removed from cracks, slab edges, construction joints, and corners by magnets, magnetic broom, air blast, vacuum, or stiff bristle broom.

C. Existing Surfaces such as Ceramic Tiles, Glazed Block, or Painted Block

1. Tile: Complete removal of existing tile is necessary prior to the installation of the specified system. Remove existing tiles and any mastics or surface contaminants down to sound substrate being careful to minimize gouging or chipping into substrate. After full removal, remove all debris and surface contaminants. All surfaces shall be clean, dry and free of contaminants prior to installing the specified system.

2. Setting Beds: Shower areas and other wet areas often have a setting bed underneath tiled floors to create slope to drains. The determination of the existence of a setting bed is not normally discovered until the tile or other floor covering is removed. When it is determined that a setting bed exists, a full removal of the setting bed down to sound concrete is required. Note: It is assumed that under any tile floor there will be a setting bed that requires removal and replacement for positive slope to drain. The contractor is to include the cost of re-sloping to drain at an average thickness not to exceed 1 inch of sloping material. Should the replacement of the setting bed require more than 1-inch average sloping material replacement, owner will be notified by contractor and issue a change order request for the additional material cost. No work is to proceed until the change order is accepted by owner/architect

3. Painted CMU or Concrete: Remove all finishes/layers of paint to get down to clean concrete substrate. If block surface is damaged during the removal process patch/fill areas damaged to make them flush with adjacent surfaces of concrete masonry units.

D. Concrete Masonry Units New Construction:

1. Masonry contractor is responsible to provide an acceptable surface for specified coating system. A visual inspection by the onsite manufacturer's representative is required to ensure that the substrate is acceptable to receive the specified coating. Any deficiencies shall be corrected by the masonry contractor. Requirements for an acceptable surface are as follows:

a. Mortar shall have a minimum of 28 days cure prior to coating. **NOTE:** If time frame does not allow for 28-day cure, masonry contractor shall use additive to mortar mix to accelerate cure time and allow coatings contract to apply specified system within 48 hours of new mortar installed.

b. Mortar joints are struck clean and filled tightly to avoid gaps or holes and to provide a neat, uniform appearance in accordance with procedures as outlined under Divison 4 – Masonry.

c. Removal of all mortar spatter, protruding mortar edges or any excessive mortar.

d. All rough edges are to be ground smooth.

e. Concrete masonry units are to be cleaned as specified under requirements as outlined under Division 4 Masonry.

f. All surfaces shall be clean, dry, free of efflorescence, or other contaminants.

E. New Concrete Walls:

1. Concrete shall have a minimum of 28 days cure prior to coating.

2. Abrasive blast or mechanically abrade to open up the skin of concrete surface and to create the proper anchor profile of CSP 2 or CSP 3 in accordance with ICRI Guideline 03732.

3. Exposed bug holes or honey combing shall be filled with manufacturer's recommended epoxy filler prior to installing coating system.

4. All surfaces shall be clean, dry and free of contaminants prior to installing coating system.

F. Cement Board:

1. Cement boards shall be installed by others with the smooth side exposed.

2. All joints shall be filled and taped by coatings contractor with manufacturer's recommended epoxy joint filler.

3. Remove any finish more than Level 3.

4. All surfaces shall be clean, dry and free of contaminants prior to installing coating system.

3.03 INSTALLATION

A. General: Apply components of resinous coating system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface at the specified thickness.

1. Coordinate application of components to provide optimum adhesion of resinous floor/wall system to substrate and intercoat adhesion.

2. At substrate control, isolation, and expansion joints, provide joint as necessary in resinous flooring in compliance with manufacturer's directions and engineering details for each joint type.

a. Apply backer rod and elastomeric joint filler into isolation or expansion joints in compliance with manufacturer's directions.

B. Installation of SES-1

1. Moisture Mitigation Primer Coat: (A moisture mitigation barrier coat is required on all surfaces at grade in areas subject to high levels of hydrostatic pressure where an effective moisture vapor barrier is not in place, or it is

unknown whether an effective moisture vapor barrier is in place to prevent excessive moisture vapor drive through the concrete slab.) When required by owner, apply one full coat of moisture mitigation primer in accordance with manufacturer's instructions. Primer must be applied direct to bare concrete that is properly prepared according to standard preparation procedures.

2. Flexible Membrane: On surfaces above grade or over occupied spaces apply one full coat of fluid applied plural component flexible membrane at 30 mils WFT being sure to pull the material up the wall the distance of the specified cove base. Allow primer/membrane coat to cure.

3. Sloping: Mixed 310K to form a trowel grade epoxy mortar. Apply new material at a slope rate of ¼ inch per foot.

4. Cove Base: Trowel applies cove base by using a mixture of 100% solids epoxy and trowel grade aggregates to form a 2-inch Can't Cove and to fully seal the joint between walls and floors and allow to set. Remove all excess material to provide neat and uniform finish.

5. Floor Base Coat: Mix 100% solids plural component floor Base Coat components with Jiffy Mixer for 2 minutes, pour onto floor in a bead, squeegee apply and backroll. Apply at 20 mils, or 80 square feet per mixed gallon. While Base Coat is wet, broadcast aggregate into base coat to rejection and allow to dry. Sweep off/vacuum up all excess aggregate.

6. Walls/Ceilings Joint Filling and Taping: (Only applies to cement board construction) Taping and filling of joints shall be filled with 100% solids thixotropic plural component epoxy joint filler and embedded with reinforcing fiberglass mesh. Filled joints shall be struck flush with cement board surface. Note: Contractor installing cement boards must install boards with smooth side exposed. Boards installed with rough side exposed will negatively impact the final finish.

7. CMU and Concrete Walls and Ceilings: Primer/Block Filler Coat: Mix and install plural component 100% solids thixotropic epoxy filler at a rate of 12-16 mils on CMU and other porous substrates and at 6-8 mils on non-porous surfaces. Allow to dry tack free.

8. Build Coat: (All Surfaces) Mix 100% solids factory filled Kevlar® and fiberglass stranded epoxy components with a Jiffy Mixer for a minimum of 2 minutes and apply to all surfaces, ceilings, walls and floors with a 45:1 air-powered airless spray rig with gravity-fed hopper at and allow curing. Minimum thickness of 45 mils.

9. Glaze Coat: After build coat is fully cured, abrade all surfaces to remove any exposed Kevlar and fiberglass strands and other imperfections. Mix final glaze coat with anti-MRSA additive for a minimum of 2 minutes and apply to walls and ceilings at 8 mils and 12-16 mils on floor surfaces. Seed and back-roll non-pulverizing slip resistant additive into final floor finish encapsulating the slip resistant additive to achieve ADA requirements.

10. The finished floor must meet ADA specifications for this project.

11. Total System thickness: Walls: 60 mils Floors: a nominal 1/8th inch

C. Manufacturer's Field Service:

1. Manufacturer will send qualified technical representative to the Project site for the following purposes:
   a. Coordinate schedule, environmental requirements, and pre-installation work with other trades.
   b. Advise Installer's personnel of procedures and precautions for use of flooring materials.
   c. Attend moisture testing and all other testing procedures with the Architect/Engineer, the Owner's Representative, and the Installer.
   d. Observe field mockups with the Engineer/Architect, the Owner's Representative, and the Installer.
   e. Ascertain that each component of the resinous flooring system is being installed in accordance with manufacturer's directions.
   f. Maintain a log of environmental conditions, work procedures, testing procedures, and protection measures to be included in job site file submittal.
   g. Manufacturer's representative shall be on site throughout the entire product installation including all the above, all surface preparation and product installation.

3.04 CURING

A. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during curing processes.

1. Temperatures shall be maintained at 70°F – 80°F throughout the installation and cure of the specified system.
2. Exposure to water during the cure process must be prevented as they will compromise epoxy component's ability to set properly.
3. Steam or any airborne contamination will adversely affect curing.

3.05 CLEANING

A. Work area shall be left clean with all trash, equipment, and leftovers removed.

B. Floor and walls may be cleaned prior to final inspection, providing complete curing has taken place. [Refer to Product Data Sheets for curing information for each product]. Generally, non-chlorinated detergents should be used for the first month after curing is complete.

C. For optimum coating performance and cleanability, manufacturer recommends the use of liquid soaps to prevent caking on epoxy surfaces caused by bar soaps.

END OF SECTION

SECTION 101423 - PANEL SIGNAGE

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. Room-identification signs.
   2. Signage accessories.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

B. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
   1. Room-Identification Signs: Full-size Sample.
   2. Exposed Accessories: Full-size Sample of each accessory type.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:

1. Basis-of-Design Product: The design for each sign is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.

1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally.

B. Basis-of-Design Product: Mohawk Sign Systems, 1000 ADA SYSTEM or a comparable product of one of the following, or by any other manufacturer who can meet requirements:

1. National Signage Affiliates
2. Bayuk Graphic Systems Inc.

C. Unframed Panel Signs: Fabricate signs with edges mechanically and smoothly finished to comply with the following requirements:

1. Edge Condition: Square cut.

D. Laminated Panels: Permanently laminate face panels to backing sheets of material; use manufacturer's standard process.

E. Graphic Content and Style: Provide sign copy that complies with requirements indicated on Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

F. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of slide-in inserts.

1. Furnish paper and software for creating text and symbols for computers for Owner production of paper inserts.
2. Furnish paper cut-to-size for changeable message insert.

G. Tactile and Braille Copy: Comply with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.

1. Panel Material: Opaque acrylic sheet or clear acrylic sheet with opaque color coating, subsurface applied.
2. Raised-Copy Thickness: Not less than 1/32 inch.
3. Tactile graphics shall be machine cut and chemically welded to sign panel surface.

2.3 PANEL SIGN TYPES

A. Room Signs:

1. Material: acrylic sheet.
2. Perimeter: Unframed.
3. Copy: Tactile and braille.
4. Character Style: Helvetica.
5. Text: As indicated in the Sign Schedule.
6. Message: Changeable.
7. Sizes:
    a. Sign: As indicated on drawings.
    b. Character: Minimum 1-inch- high characters.
8. Colors: As selected from manufacturer’s full range.
9. Schedule: Refer to door schedule.

B. Occupancy Signs:

1. Material: acrylic sheet.
2. Perimeter: Unframed.
3. Copy: Raised.
4. Character Style: Helvetica.
5. Text: Maximum occupancy load: 10 persons.
6. Message: Fixed.
7. Sizes:

a. Sign: As indicated on drawings
b. Character: Minimum 1-inch- high characters.

8. Colors: As selected from manufacturer's full range.
9. Schedule: Refer to door schedule.

C. Toilet Room Signs/Symbols:

1. Material: acrylic sheet.
2. Perimeter: Unframed.
3. Copy: Raised.
4. Character Style: Helvetica.
5. Text: According to requirements in the ADA or of authorities having jurisdiction, whichever are more stringent.
6. Message: Fixed.
7. Sizes:

a. Sign: As indicated on drawings
b. Character: Minimum 1-inch- high characters.

8. Colors: As selected from manufacturer's full range.
9. Schedule: Refer to door schedule.

2.4 PANEL-SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 316, stretcher-leveled standard of flatness.

D. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

E. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.

F. Fiberglass Sheet: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.

G. PVC Sheet: Manufacturer's standard, UV-light stable, PVC plastic.

H. Plastic-Laminate Sheet: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

I. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

J. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

    a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant spanner-head slots unless otherwise indicated.

4. Sign Mounting Fasteners:

    a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
    b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
    c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

5. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70 g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Adhesives: As recommended by sign manufacturer and that 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. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

E. Hook-and-Loop Tape: Manufacturer's standard two-part tape consisting of hooked part on sign back and looped side on mounting surface.

F. Magnetic Tape: Manufacturer's standard magnetic tape with adhesive on one side.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.6 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace signs for stability and for securing fasteners.
6. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into panel surface indicated to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.
2. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
3. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.
4. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.

C. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

D. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

2.7 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

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 signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
6. Magnetic Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position.

D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102800 - TOILET, BATH, AND LAUNDRY 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. Washroom accessories.
2. Private-use bathroom accessories.
3. Underlavatory guards.
4. Custodial accessories.

B. Related Requirements:

1. Section 061000: Rough Carpentry.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

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

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **15** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.

B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.

D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.

E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 SINGLE OCCUPANT TOILET ROOM ACCESSORIES

A. See accessories for Locker Room Accessories listed below.

2.3 LOCKER ROOM WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc. (ASI)
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.

B. Toilet Tissue (Roll) Dispenser:

1. Basis-of-Design Product: ASI Roval Collection 20030
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 5-inch- diameter tissue rolls.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Combination Towel (Folded) Dispenser/Waste Receptacle:

1. Basis-of-Design Product: ASI Roval Collection 20469
2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle.
3. Mounting: Semirecessed.

    a. Designed for nominal 4-inch wall depth.

4. Minimum Towel-Dispenser Capacity: 600 C-fold or 800 multifold paper towels.
5. Minimum Waste-Receptacle Capacity: 13 gal..
6. Material and Finish: Stainless steel, No. 4 finish (satin).
7. Lockset: Tumbler type for towel-dispenser compartment and waste receptacle.

D. Liquid-Soap Dispenser:

1. Basis-of-Design Product: ASI Roval Collection 20363
2. Description: Designed for dispensing soap in liquid or lotion form.
3. Mounting: Horizontally oriented, surface mounted.
4. Capacity: 57 oz.
5. Materials: Stainless steel, No. 4 finish (satin).
6. Lockset: Tumbler type.
7. Refill Indicator: Window type.

E. Grab Bar:

1. Basis-of-Design Product: ASI 3200 Series
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

    a. Finish: Smooth, No. 4, satin finish on ends and slip-resistant texture in grip area.

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

F. Sanitary –Napkin Dispenser Unit.

1. Basis-of-Design Product: ASI Roval Collection 204684
2. Type: Sanitary napkin and tampon.
3. Mounting: Fully recessed, designed for 4-inch wall depth.
4. Operation: Two coin (50 cents).
5. Exposed Material and Finish: Stainless steel, No. 4 finish (satin)
6. Lockset: Tumbler type with separate lock and key for coin box.

G. Sanitary-Napkin Disposal Unit:

1. Basis-of-Design Product: ASI Roval Collection 20852
2. Mounting: Surface mounted.
3. Door or Cover: Self-closing disposal-opening cover.
4. Receptacle: Removable.
5. Material and Finish: Stainless steel, No. 4 finish (satin).
6. .

H. Mirror Unit:

1. Basis-of-Design Product: ASI Roval Collection 20650
2. Frame: Stainless-steel radius edge.
    a. Corners: Mitered, welded and ground smooth.
3. Hangers: 18 Gauge hanger bracket. Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    a. Tamperproof mounting and locking hex socket headless set screw #10-32 x 1-1/4”

4. Size: As indicated on Drawings.

2.4 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. TCI Products.
3. Truebro, Inc.

B. Underlavatory Guard:

1. Basis-of-Design Product: Truebro 103E-Z LAV Guard
2. Description: Insulating pipe covering for supply and drain piping assemblies, that prevent direct contact with and burns from piping, and allow service access without removing coverings.
3. Material and Finish: Molded-plastic, white.

2.5 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of **six** keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

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 portable, fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each mounting bracket 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. Badger Fire Protection; a Kidde company.
   b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
   d. Larsen's Manufacturing Company.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Carbon Dioxide Type: UL-rated 10-B:C, 15-lb nominal capacity, with carbon dioxide in manufacturer's standard enameled-metal container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

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. Badger Fire Protection; a Kidde company.
   b. J. L. Industries, Inc.; a division of Activar Construction Products Group.
   c. Larsen's Manufacturing Company.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

SECTION 105050 -METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Heavy-duty metal gear lockers.
2. Locker benches.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.

B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.

1. Show locker trim and accessories.
2. Include locker identification system and numbering sequence.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For metal lockers and locker benches, in manufacturer's standard sizes.

E. Qualification Data: For qualified Installer.

F. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

G. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain metal lockers, locker benches, and accessories from single source from single manufacturer.

C. Regulatory Requirements: Where metal lockers and benches are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Deliver master and control keys and/or combination control charts to Owner by registered mail or overnight package service.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures.
    b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Full-size units of the following metal locker hardware items equal to 10 percent of amount installed for each type and finish installed, but no fewer than five units:

a. Locks.
b. Identification plates.
c. Accessory components as listed below.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

B. Expanded Metal: ASTM F 1267, Type II (flattened), Class I, 3/4-inch steel mesh, with at least 70 percent open area.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Extruded Aluminum: ASTM B 221, alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated.

E. Steel Tube: ASTM A 500, cold rolled.

F. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

G. Anchors: Material, type, and size required for secure anchorage to each substrate.

H. Recycled Content: Provide products with recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content constitutes a minimum of 25 percent by weight.

2.2 HEAVY-DUTY DOUBLE DOOR METAL GEAR LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Penco Vanguard Lockers or comparable product by another manufacturer:

B. Locker Arrangement: Single tier.

C. Material: Cold-rolled steel sheet.

D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Sides: 16 gauge steel
2. Tops and Bottoms: three sides formed 90 degrees, the front offset formed to be flush with horizontal frame member.
3. Backs: 18 gauge steel.
4. Shelves: 14 gauge with double bend at front and single bend at sides and back.

E. Frames: Channel formed; fabricated from 14 gauge steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames. Intermembering parts to be mortised and tenoned and electrically welded together in a rigid assembly capable of resisting strain.

F. Assembly Hardware: Zinc plated truss fin head bolts and hex nuts. Optional factory assemble of locker bodies using rivits.

G. Double Doors: One piece; fabricated from 14 gauge steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Door Style:
   a. Louvered Vents: No fewer than six louver openings at top and bottom for single-tier lockers.

H. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees; self-closing.
1. Continuous Hinges: 16 gauge piano hinge measuring full height of door. Welded to door and attached to locker frame using steel rivets.

I. Cremone Latching: Handle shall be a heavy duty handle that secures the door at three points. The top and bottom frames are engaged with 3/8” steel rods, and a 1/8 inch thick center latch engages at the side. Double door configurations shall consist of a left hinged door secured its full length by the right hinged door when latched. Handle assembly shall be secured to door using a threaded lock nut to facilitate adjustment and removal for repair if necessary. Welded handle assemblies shall not be accepted.

J. Combination Padlocks: Key-controlled, three-number dialing combination locks; capable of five combination changes.

K. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
1. Shelf: 16 gauge full width located approximately 12” below top of locker.
2. Hooks and coat rod: Two heavy duty 3” high, 7/8” wide 2 1/2” deep single prong wall hooks and one chrome plated 1” diameter coat rod.
3. Cell phone/key trays.

L. Accessories:

1. Continuous Sloping Tops: Fabricated from 0.048-inch nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

    a. Closures: Vertical-end type.

2. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
3. Filler Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.
4. Boxed End Panels: Fabricated from 0.048-inch nominal-thickness steel sheet.

M. Sheet Metal Pipe Covers: Sheet metal jackets at exposed RWL for overflow roof drain . Match adjacent locker color.

N. Finish: Finish coat shall be electrostatically applied powder coat enamel properly cured to paint manufacturers specifications to achieve optimum performance. All lockers shall be painted inside and outside with the same color.

1. Dry Thickness: 1 to 1.2 mils
2. Colors: As indicated on drawings by manufacturer's designations.

2.3 LOCKER BENCHES

A. Provide bench units with overall assembly height of 17-1/2 inches. Length as shown on drawings.

B. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 9-1/2 inches wide by 1-1/4 inches thick except provide minimum 20-inch- wide tops where accessible benches are indicated.
2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

C. Bench Backs: Manufacturer’s standard clear hardwood where indicated on drawings at accessible benches not adjacent to wall.

D. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel: 1-1/2-inch- diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.

    a. Color: As selected by Architect from manufacturer's full range.

2.4 FABRICATION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.

D. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches above the floor.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

F. Coat Rods: Fabricated from 1-inch- diameter steel, chrome finished.

G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch high.

H. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

I. Individual Sloping Tops: Fabricated in width to fit one locker frame in lieu of flat locker tops; with integral back; finished to match lockers. Provide wedge-shaped divider panels between lockers.

J. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers.

K. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

L. Boxed End Panels: Fabricated with 1-inch- wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

M. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

1. Provide one-piece panels for double-row (back-to-back) locker ends.

N. Center Dividers: Full-depth, vertical partitions between bottom and shelf; finished to match lockers.

2.5 STEEL SHEET FINISHES

A. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

B. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

2.6 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers and to floor.
3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.

4. Attach recess trim to recessed metal lockers with concealed clips.
5. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
6. Attach sloping-top units to metal lockers, with closures at exposed ends.
7. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

D. Fixed Locker Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105050

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes manually operated roller shades.

B. Related Sections:

1. Section 061053 “Miscellaneous Rough Carpentry”
2. Section 084113 “Aluminum-Framed Entrances and Storefronts”

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Draper manual Flex Shade or a comparable product by one of the following:

1. Hunter Douglas
2. Lutron Electronics Co., Inc.
3. MechoShade Systems, Inc.

2.2 ROLLER SHADES

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Manufacturer's standard.
    a. Loop Length: Full length of roller shade.
    b. Limit Stops: Provide upper and lower ball stops.
    c. Chain-Retainer Type: Clip, jamb mount.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Mounting Configuration: Single roller.
2. Direction of Shadeband Roll: Regular, from back of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

E. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 4 inches.

2. Endcap Covers: To cover exposed endcaps.
3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
   a. Closure-Panel Width: 2 inches.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 FABRIC/SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Room Darkening Fabrics: SunBloc Series SB9000: Close woven fiberglass base textile with sun-resistant vinyl film bonded to each side, opaque with minimum tensile strength of 190 pounds for warp and 180 pounds for fill. Fire rating: NFPA 701 1006-Test 1. Washable and stain resistant. Wt. 12 oz/sq yd. Same color both sides, .015 inches thick.

1. Roll Width: As required to cover window sizes indicated on Drawings
2. Color: As selected by Architect from manufacturer's full range.

C. Light-Filtering Fabric: SheerWeave Series SW2400 by Phifer: VOC Emissions: Greenguard children and schools –certified as a low emitting fabric. Manufacturer to supply Greenguard children and schools certificate. 500 denier fiberglass, vinyl coated and woven into a 2x2 basket weave. Fire rating: NFPA 701. Bacteria and funal resistance: ASTM G21 and ASTM G22. Series SW2400, 3 percent open, 0.19 inches thick.

1. Roll Width: As required to cover window sizes indicated on Drawings
2. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 ROLLER-SHADE INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances,and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Install roller shades level, plumb, and aligned with adjacent units, according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

D. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

E. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

END OF SECTION 122413

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal hanger-shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe-positioning systems.
10. Equipment supports.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

B. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 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. Stainless-Steel Pipe Hangers and Supports:

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

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.3 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.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1 steel pipe hanger, except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10 steel pipe hanger, except hanger is made of fiberglass-reinforced resin.

    a. Flammability: ASTM D635, ASTM E84, UL 94.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.5 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc or Hot-dip galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Select for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Hot-dip galvanized

2.6 FIBERGLASS STRUT SYSTEMS

A. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.

1. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
2. Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.
3. Channel Width: Selected for applicable load criteria.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 THERMAL HANGER-SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: [ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig, ASTM C552, Type II cellular glass with 100-psig, or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.8 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 or stainless steel.
2. Outdoor Applications: Stainless steel.

2.9 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.
4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
5. Pipe Supports: Roller, Strut clamps, Clevis hanger, or Swivel hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads.
8. Height: 12 inches above roof.

D. High-Profile, Single-Base, Single-Pipe Stand:

1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Single vulcanized rubber or molded polypropylene.
3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch rods.
4. Horizontal Member: One adjustable-height, galvanized or stainless-steel, pipe-support slotted channel or plate.
5. Pipe Supports: Roller, Clevis hanger or Swivel hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads, 1/2-inch, continuous-thread, galvanized-steel rod
8. Height: 36 inches above roof.

E. High-Profile, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: Two or more; vulcanized rubber or molded polypropylene.
3. Vertical Members: Two or more, galvanized-steel channels.
4. Horizontal Members: One or more, adjustable-height, galvanized-steel pipe support.
5. Pipe Supports: Roller, Strut clamps, Clevis hanger, or Swivel hanger.
6. Hardware: Galvanized steel.

7. Accessories: Protection pads, 1/2-inch, continuous-thread rod.
8. Height: 36 inches above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.10 PIPE-POSITIONING SYSTEMS

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

2.11 EQUIPMENT SUPPORTS

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

2.12 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011.

C. Structural Steel: ASTM A36 carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240.

E. Grout: ASTM C1107, 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 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

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 carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

D. Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

F. 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.

G. Pipe Stand Installation:

1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

H. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

I. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

K. 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.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. 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.

N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

P. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

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. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 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.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 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.

3.7 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, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers, and fiberglass pipe hangers, and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger-shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. 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. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. 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.
5. 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.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.

15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-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.

N. 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.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include

auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220719 - 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 chilled-water piping for drinking fountains.
4. Sanitary waste piping exposed to freezing conditions.
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).

B. Sustainable Design Submittals:

C. Product Data: For adhesives, mastics, and sealants, indicating VOC content.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products 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.

1.5 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. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.6 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," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

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

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

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Comply with ASTM C552.
1. Preformed Pipe Insulation: Type II, Class 1, without jacket.
2. Preformed Pipe Insulation: Type II, Class 2, with factory-applied ASJ-SSL jacket.
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.

H. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.
1. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
2. Service Temperature Range: 0 to plus 850 deg F.
3. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Phenolic: Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C1126.
1. Preformed Pipe Insulation: Type III**,** with factory-applied ASJ.
2. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C534/C534M or ASTM C1427, Type I, Grade 1, for tubular materials.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C195.

Commented [A1]: What is this?

Commented [A2R1]: Likely referencing this material. Addition made based on datasheet.
10017691 PipeInsul Compliance Tech Bulletin.indd

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
1. Adhesive: As recommended by cellular glass manufacturer and with a VOC content of **80** g/L or less

C. Flexible Elastomeric and Polyolefin Adhesive: Solvent-based adhesive.
1. Flame-spread index shall be 25 or less and smoke-developed index shall be 50 or less as tested in accordance with ASTM E84.
2. Wet Flash Point: Below 0 deg F.
3. Service Temperature Range: 40 to 200 deg F.
4. Color: Black.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Adhesive: As recommended by mineral fiber manufacturer and with a VOC content of **80** g/L or less.

E. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
1. Adhesive: As recommended by phenolic manufacturer and with a VOC content of **50** g/L or less

F. ASJ Adhesive and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.
1. Verify adhesives have a VOC content of **80** g/L or less.

G. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS AND COATINGS

A. Materials shall be compatible with insulation materials, jackets, and substrates.

1. Mastics: As recommended by insulation manufacturer and with a VOC content of **50** g/L or less.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
2. Service Temperature Range: 0 to plus 180 deg F .
3. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
4. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
2. Service Temperature Range: 0 to 180 deg F.
3. Color: White.

D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.
1. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
2. Service Temperature Range: 0 to plus 180 deg F.
3. Color: White.

2.5 LAGGING ADHESIVES

A. Adhesives shall comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
1. Verify adhesive is as recommended by insulation manufacturer and has a VOC content of 50 g/L or less.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 20 to plus 180 deg F.
4. Color: White.

2.6 SEALANTS

A. Materials shall be as recommended by the insulation manufacturer and shall be compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:
1. Permanently flexible, elastomeric sealant.
2. Service Temperature Range: Minus 58 to plus 176 deg F.
3. Color: White or gray.
4. Verify sealant has a VOC content of 420 g/L or less.

C. FSK and Metal Jacket Flashing Sealants:
1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.
3. Color: Aluminum.
4. Verify sealant has a VOC content of 420 g/L or less

D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
1. Fire- and water-resistant, flexible, elastomeric sealant.
2. Service Temperature Range: Minus 40 to plus 250 deg F.

3. Color: White.
4. Verify sealant has a VOC content of 420 g/L or less

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C1136, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

    a. Sheet and roll stock ready for shop or field sizing
    b. Finish and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2. Stainless-Steel Jacket: ASTM A240/A240M.

    a. Sheet and roll stock ready for shop or field sizing
    b. Material, finish, and thickness are indicated in field-applied jacket schedules.
    c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
    d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    e. Factory-Fabricated Fitting Covers:

        1) Same material, finish, and thickness as jacket.
        2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
        3) Tee covers.
        4) Flange and union covers.
        5) End caps.
        6) Beveled collars.
        7) Valve covers.
        8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

E. Underground Direct-Buried Jacket: 125-mil- thick vapor barrier and waterproofing membrane, consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

F. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with stucco-embossed aluminum-foil facing.

2.11 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. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.
   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.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
   1. Width: 2 inches.
   2. Thickness: 6 mils.
   3. Adhesion: 64 ounces force/inch in width.
   4. Elongation: 500 percent.
   5. Tensile Strength: 18 lbf/inch in width.

D. 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.

2.12 SECUREMENTS

A. Bands:
   1. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
   2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

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

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

2.13 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers
   1. 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. 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. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

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

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. 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 Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through 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, 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 CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe 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. Secure according to manufacturer's written instructions.

2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF 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 that of 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 that of 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.

3.8 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.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless steel bands at 12-inch intervals, and tighten bands without deforming insulation materials.
2. Install two-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless steel bands at 12-inch intervals.

B. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets with vapor retarders on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

C. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of same material and thickness as that of pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as that of straight segments of pipe insulation. Secure according to manufacturer's written instructions.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube 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 polyolefin sheet insulation of same thickness as that of 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 polyolefin 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 cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
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.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.12 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.14 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.

3.15 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

NPS 1 and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1/2 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
d. Phenolic: 1 inch thick.
e. Polyolefin: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.
e. Polyolefin: 1 inch thick.

B. Domestic Chilled Water (Potable):

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

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.
e. Polyolefin: 1 inch thick.

C. Stormwater and Overflow:

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

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.
e. Polyolefin: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

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

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 1 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
d. Phenolic: 1 inch thick.
e. Polyolefin: 1 inch thick.

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

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

a. Flexible Elastomeric: 1/2 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
c. Polyolefin: 1/2 inch thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

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

a. Cellular Glass: 2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.
c. Phenolic: 1-1/2 inches thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

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

a. Cellular Glass: 1-1/2 inches thick.
b. Flexible Elastomeric: 3/4 inch thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
d. Phenolic: 1 inch thick.
e. Polyolefin: 3/4 inch thick.

H. Hot Service Drains:

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

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

I. Hot Service Vents:

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

a. Cellular Glass: 1-1/2 inches thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.16 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping:

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

a. Cellular Glass: 2 inches thick.
b. Flexible Elastomeric: 2 inches thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
d. Phenolic: 2 inches thick.
e. Polyolefin: 2 inches thick.

B. Sanitary Waste Piping Where Heat Tracing Is Installed:

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

    a. Cellular Glass: 2 inches thick.
    b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.
    c. Phenolic: 2 inches thick.

C. Hot Service Drains:

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

    a. Cellular Glass: 1-1/2 inches thick.
    b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Hot Service Vents:

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

    a. Cellular Glass: 1-1/2 inches thick.
    b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.17 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

B. Chilled Water, All Sizes: Cellular glass, 2 inches thick.

3.18 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. Aluminum, Stucco Embossed 0.024 inch thick.

D. Piping, Exposed:
1. Aluminum, Stucco Embossed: 0.024 inch thick

3.19 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, Concealed:
1. Aluminum, Stucco Embossed: 0.024 inch thick.

D. Piping, Exposed:
   1. Aluminum, Stucco Embossed 0.024 inch thick.

3.20 UNDERGROUND, FIELD-APPLIED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Ductile-iron pipe and fittings.
3. Galvanized-steel pipe and fittings.
4. Stainless steel piping and fittings.
5. CPVC piping.
6. PEX tube and fittings.
7. PEX-AL-PEX tube and fittings.
8. PEX-AL-HDPE tube and fittings.
9. PVC pipe and fittings.
10. PP-R pipe and fittings.
11. Piping joining materials.
12. Encasement for piping.
13. Transition fittings.
14. Dielectric fittings.

B. Related Requirements:

1. Section 221113 "Facility Water Distribution Piping" for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.
3. Joining materials.
4. Transition fittings.

B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

C. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type L.

B. Annealed-Temper Copper Tube: ASTM B88, Type L

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

G. Wrought Copper Unions: ASME B16.22.

H. Grooved, Mechanical-Joint, Copper Tube Appurtenances:
1. Grooved-End, Copper Fittings: ASTM B75 copper tube or ASTM B584 bronze castings.
2. Grooved-End-Tube Couplings: To fit copper-tube dimensions; rigid pattern unless otherwise indicated; gasketed fitting, EPDM-rubber gasket, UL classified per NSF 61 and NSF 372, and rated for minimum 180 deg F, for use with ferrous housing and steel bolts and nuts; 300 psig minimum CWP pressure rating.

I. Copper Tube, Pressure-Seal-Joint Fittings:
1. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
2. Minimum 200-psig working-pressure rating at 250 deg F.

J. Copper-Tube, Push-on-Joint Fittings:
1. Description:

a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
b. Stainless steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Push-on-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51.
2. Push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

E. Standard-Pattern, Push-on-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Gaskets: AWWA C111/A21.11, rubber.

F. Compact-Pattern, Push-on-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Gaskets: AWWA C111/A21.11, rubber.

G. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

H. Appurtenances for Grooved-End, Ductile-Iron Pipe:
1. Fittings for Grooved-End, Ductile-Iron Pipe: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions that match pipe.
2. Mechanical Couplings for Grooved-End, Ductile-Iron-Piping:

a. AWWA C606 for ductile-iron-pipe dimensions.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating:

1) NPS 14 to NPS 18: 250 psig.
2) NPS 20 to NPS 46: 150 psig.

2.4 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe:

1. ASTM A53/A53M, Type E, Grade B, Standard Weight.
2. Include ends matching joining method.

B. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless steel pipe with threaded ends.

C. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Malleable-Iron Unions:

1. ASME B16.39, Class 150.
2. Hexagonal-stock body.
3. Ball-and-socket, metal-to-metal, bronze seating surface.
4. Threaded ends.

E. Flanges: ASME B16.1, Class 125, cast iron.

F. Appurtenances for Grooved-End, Galvanized-Steel Pipe:
1. ASTM Fittings for Grooved-End, Galvanized-Steel Pipe: Galvanized, ASTM A47/A47M, malleable-iron casting; ASTM A106/A106M, steel pipe; or ASTM A536, ductile-iron casting; with dimensions matching steel pipe.
2. AWWA Fittings for Grooved-End, Galvanized-Steel Pipe:

a. AWWA C606 for steel-pipe dimensions.
b. Ferrous housing sections.
c. EPDM-rubber gaskets suitable for hot and cold water.
d. Bolts and nuts.
e. Minimum Pressure Rating:

1) NPS 8 and Smaller: 600 psig.
2) NPS 10 and NPS 12: 400 psig
3) NPS 14 to NPS 24: 250 psig.

2.5 STAINLESS STEEL PIPING

A. Potable-water piping and components shall comply with NSF 61 and NSF 372.

B. Stainless Steel Pipe: ASTM A312/A312M, with wall thickness as indicated in "Piping Applications" Article.

C. Stainless Steel Pipe Fittings: ASTM A815/A815M.

D. Appurtenances for Grooved-End, Stainless Steel Pipe:
   1. Fittings for Grooved-End, Stainless Steel Pipe: Stainless steel casting with dimensions matching stainless steel pipe.
   2. Mechanical Couplings for Grooved-End, Stainless Steel Pipe:

      a. AWWA C606 for stainless steel-pipe dimensions.
      b. Stainless steel housing sections.
      c. Stainless steel bolts and nuts.
      d. EPDM-rubber gaskets suitable for hot and cold water.
      e. Minimum Pressure Rating:

         1) NPS 8 and Smaller: 600 psig.
         2) NPS 10 and NPS 12: 400 psig.
         3) NPS 14 to NPS 24: 250 psig .

E. Stainless Steel Piping , Pressure-Seal-Joint Fittings:
   1. Material: Type 316 stainless steel, ASTM A312/A312M, Schedule 10.
   2. Fittings: Type 316 stainless steel with EPDM O-ring seal in each end, and approved for potable water applications.
   3. Listing: ICC-ES LC1002 or UL Classified in accordance with ANSI/NSF 61 and 372.
   4. Minimum 200-psig working-pressure rating at 250 deg F.

2.6 CPVC PIPING

A. CPVC Pipe: ASTM F441/F441M, with wall thickness as indicated in "Piping Applications" Article.

   1. CPVC Socket Fittings: ASTM F439 for Schedule 80.
   2. CPVC Threaded Fittings: ASTM F437, Schedule 80.

B. CPVC Piping System: ASTM D2846/D2846M, SDR 11, pipe and socket fittings.

2.7 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D1785, with wall thickness as indicated in "Piping Applications" Article.

B. PVC Socket Fittings: ASTM D2467 for Schedule 80.

C. PVC Schedule 80 Threaded Fittings: ASTM D2464.

2.8 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 B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F493.

G. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer according to ASTM F656.

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.9 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.

B. Form: Sheet or tube.

C. Color: Black.

2.10 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.

D. Plastic-to-Metal Transition Fittings:
1. Description:

a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Description:

    a. CPVC or PVC four-part union.
    b. Brass or stainless steel threaded end.
    c. Solvent-cement-joint or threaded plastic end.
    d. Rubber O-ring.
    e. Union nut.

2.11 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: 150 psig.
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: 150 psig.
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 F1545.
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 APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:

1. Annealed-temper copper tube, ASTM B88, Type L wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
3. Push-on-joint, ductile-iron pipe; standard-pattern, push-on-joint fittings; and gasketed joints.
4. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
5. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

F. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12 shall be one of the following:

1. Mechanical-joint, ductile-iron pipe; standard-pattern, mechanical-joint fittings; and mechanical joints.
2. Push-on-joint, ductile-iron pipe; standard-pattern, push-on-joint fittings; and gasketed joints.
3. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.

G. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Drawn-temper or annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

H. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
2. Drawn-temper copper tube, ASTM B88, Type L; cast-copper, solder-joint fittings; and brazed joints.
3. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
4. Drawn-temper copper tube, ASTM B88, Type L; copper push-on-joint fittings; and push-on joints.
5. Stainless steel, Schedule 10 pipe; pressure-seal-joint fittings; and pressure-sealed joints.
6. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.

7. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
8. CPVC Tubing System: CPVC tube; CPVC socket fittings; and solvent-cemented joints.
9. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

I. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Drawn-temper copper tube, ASTM B88, Type L; cast-copper, solder-joint fittings; and brazed joints.
2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Drawn-temper copper tube, ASTM B88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
4. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
5. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
6. Stainless steel, Schedule 10 pipe; grooved-joint fittings, and grooved joints.
7. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
8. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
9. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

J. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:

1. Drawn-temper copper tube, ASTM B88, Type L; cast-copper, solder-joint fittings; and brazed joints.
2. Drawn-temper copper tube, ASTM B88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.
3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
4. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
5. Stainless steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.
6. CPVC, Schedule 80; socket fittings; and solvent-cemented joints.
7. CPVC, Schedule 80 pipe; CPVC, Schedule 80 threaded fittings; and threaded joints.
8. PVC, Schedule 80; socket fittings; and solvent-cemented joints.

K. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12, shall be one of the following:

1. Plain-end, ductile-iron pipe; grooved-joint, ductile-iron-pipe appurtenances; and grooved joints.
2. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.
3. Galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.
4. Stainless steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A674 or AWWA C105/A21.5.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

F. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

G. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

H. 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.

I. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

J. Install piping to permit valve servicing.

K. 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.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."

P. Install thermometers on outlet piping from each water heater.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Square cut groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or

pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D2846/D2846M Appendix.
3. PVC Piping: Join according to ASTM D2855.

N. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 : Use dielectric flanges.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 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."

B. Install hangers for copper, ductile iron, galvanized steel, and stainless steel, tubing and 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. Install vinyl-coated hangers for CPVC and 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.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper, ductile iron, galvanized steel, and stainless steel, tubing and piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of CPVC and PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 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 exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 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. Hydrostatic testing and documentation of test results for polypropylene piping to be in accordance with the manufacturer's instructions and submitted to the manufacturer upon successful completion per warranty requirements.
f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
g. 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.

3.11 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. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Galvanized-steel pipe and fittings.
4. Stainless-steel drainage pipe and fittings.
5. Ductile-iron pipe and fittings.
6. Copper tube and fittings.
7. ABS pipe and fittings.
8. PVC pipe and fittings.
9. Specialty pipe fittings.
10. Encasement for underground metal piping.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

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 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. Waste, Force-Main Piping: 100 psig.

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 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service and Extra Heavy classes.

B. Gaskets: ASTM C 564, rubber.

C. Caulking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Cast-Iron, Hubless-Piping Couplings:
1. Standard: ASTM C 1277.
2. 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.

2.5 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

C. Steel Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.

2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:
1. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
2. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

2.6 STAINLESS-STEEL DRAINAGE PIPE AND FITTINGS

A. Description: Comply with requirements of ASME A112.3.1, drainage pattern.

B. Material: Type 304 or 316L stainless steel.

C. Pipe Construction: Seamless.

D. Internal Sealing Rings: EPDM, marked or color coded for the application.

E. Joints: Single or double, socket and spigot ends.

2.7 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

C. Ductile-Iron, Grooved-Joint Piping: AWWA C151/A21.51, with round-cut-grooved ends according to AWWA C606.

D. Ductile-Iron, Grooved-End Pipe Appurtenances:
1. Grooved-End, Ductile-Iron Fittings: ASTM A 536 ductile-iron castings, with dimensions matching AWWA C110/A 21.10 ductile-iron pipe or AWWA C153/A 21.53 ductile-iron fittings, and complying with AWWA C606 for grooved ends.
2. Grooved Mechanical Couplings for Ductile-Iron Pipe: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber center-leg gasket suitable for hot and cold water; and bolts and nuts.

2.8 COPPER TUBE AND FITTINGS

A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.

D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

E. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.9 ABS PIPE AND FITTINGS

A. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

B. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

C. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

D. Solvent Cement: ASTM D 2235.

2.10 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.

E. Solvent Cement: ASTM D 2564.

2.11 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. Standard: ASTM C 1173.
    b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.
    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.

3. Shielded, Nonpressure Transition Couplings:
    a. Standard: ASTM C 1460.
    b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    c. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:
    a. Standard: AWWA C219.
    b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    c. Center-Sleeve Material: Manufacturer's standard.
    d. Gasket Material: Natural or synthetic rubber.
    e. Metal Component Finish: Corrosion-resistant coating or material.

B. Dielectric Fittings:

1. Dielectric Unions:

a. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 150 psig
3) End Connections: Solder-joint copper alloy and threaded ferrous.

2. Dielectric Flanges:
a. Description:

1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 150 psig.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:
a. Description:

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.

4. Dielectric Nipples:
a. 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.

2.12 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch or high-density, cross-laminated polyethylene film of 0.004-inch minimum thickness.

C. Form: Sheet or tube.

D. Color: Black.

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 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 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.

K. 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.

L. 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.

M. 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.

N. Install steel piping according to applicable plumbing code.

O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground ABS and PVC piping according to ASTM D 2321.

T. 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.

U. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

2. 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.

3. Install drains in sanitary waste gravity-flow piping.

V. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

W. Install sleeves for piping penetrations of walls, ceilings, and floors.

X. Install sleeve seals for piping penetrations of concrete walls and slabs.

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. 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.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

    a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    c. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

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: Unshielded, 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 unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 VALVE INSTALLATION

A. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

B. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

C. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.

3.5 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 stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. 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.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron, steel, stainless-steel, and copper 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. Install hangers for ABS and 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.

D. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

E. Support vertical runs of cast iron, steel, stainless-steel, and copper soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of ABS and PVC piping to comply with manufacturer's written instructions, 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. 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. Install horizontal backwater valves in pit with pit cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts and drains.
7. Equipment: Connect waste piping as indicated.

a. Provide shutoff valve if indicated and union for each connection.
b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. 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.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

3.8 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.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

a. Isolate test source and allow to stand for four hours.
b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.9 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. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 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 any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.
6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings, sealing rings, and gasketed joints.
5. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Stainless-steel pipe and fittings gaskets, and gasketed joints.
5. Copper Type DWV tube, copper drainage fittings, and soldered joints.

    a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.

6. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
7. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
8. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Aboveground, vent piping NPS 5 and larger shall be any of the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Galvanized-steel pipe, drainage fittings, and threaded joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
5. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Stainless-steel pipe and fittings, gaskets, and gasketed joints.
4. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
5. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
6. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

G. Underground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Extra Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
3. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
4. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

H. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.

I. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Galvanized-steel pipe, pressure fittings, and threaded joints.
3. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

J. Underground sanitary-sewage force mains NPS 4 shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

K. Underground sanitary-sewage force mains NPS 5 and larger shall be any of the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. Ductile-iron, mechanical-joint piping and mechanical joints.
3. Ductile-iron, push-on-joint piping and push-on joints.
4. Ductile-iron, grooved-joint piping and grooved joints.
5. Pressure transition couplings if dissimilar pipe materials.

END OF SECTION 221316

SECTION 221319.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Floor drains.
2. Floor sinks.
3. Trench drains.
4. Channel drainage systems.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

1.4 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. Cast-Iron Floor Drains
1. Standard: ASME A112.6.3.
2. Pattern: Area Floor drain.
3. Body Material: Gray iron.
4. Seepage Flange: Not required.
5. Anchor Flange: Not required.
6. Clamping Device: Not required.
7. Outlet: Bottom.
8. Backwater Valve: Drain-outlet type.
9. Sediment Bucket: Not required.
10. Top or Strainer Material: Bronze.
11. Top of Body and Strainer Finish: Nickel bronze.
12. Top Shape: Round.
13. Funnel: Not required.
14. Inlet Fitting: Not required.
15. Trap Material: Bronze.
16. Trap Pattern: Standard P-trap.
17. Trap Features: Cleanout.

B. Stainless-Steel Floor Drains, ASME A112.3.1:
1. Outlet: Bottom
2. Top or Strainer Material: Stainless steel.
3. Top Shape: Round.
4. Seepage Flange: Not required.
5. Anchor Flange: Not required.
6. Clamping Device: Not required.
7. Trap-Primer Connection: Not required.
8. Trap Material: Cast iron.
9. Trap Pattern: Standard P-trap

C. Stainless-Steel Floor Drains, ASME A112.6.3:
1. Outlet: Bottom
2. Top or Strainer Material: Stainless steel.
3. Top Shape: Round.
4. Seepage Flange: Not required.
5. Anchor Flange: Not required.
6. Clamping Device: Not required.
7. Trap-Primer Connection: Not required.
8. Trap Material: Cast iron.
9. Trap Pattern: Standard P-trap.

D. Plastic Floor Drains:
1. Standard: ASME A112.6.3.
2. Material: ABS or PVC.
3. Seepage Flange: Not required.
4. Clamping Device: Not required.
5. Outlet: Bottom.
6. Sediment Bucket: Not required.
7. Top or Strainer Material: Bronze.

8. Top of Body and Strainer Finish: Nickel bronze.
9. Top Shape: Round.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

2.3 FLOOR SINKS

A. Cast-Iron Floor Sinks:
1. Standard: ASME A112.6.7.
2. Pattern: Floor drain.
3. Body Material: Cast iron.
4. Anchor Flange: Not required.
5. Clamping Device: Not required.
6. Outlet: Bottom, no-hub connection.
7. Coating on Interior Surfaces: Not required.
8. Sediment Bucket: Not required.
9. Internal Strainer: Flat.
10. Internal Strainer Material: Aluminum.
11. Top Grate Material: Cast iron, loose.
12. Top of Body and Grate Finish: Nickel bronze.
13. Top Shape: Round.
14. Top Loading Classification: No traffic.
15. Funnel: Not required.

B. Stainless-Steel Floor Sinks, ASME A112.6.7:
1. Standard: ASME A112.6.7.
2. Pattern: Floor drain.
3. Body Material: Stainless steel.
4. Anchor Flange: Not required.
5. Clamping Device: Not required.
6. Outlet: Bottom, no-hub connection.
7. Sediment Bucket: Not required.
8. Internal Strainer: Flat.
9. Internal Strainer Material: Stainless steel.
10. Top Grate Material: Stainless steel, loose.
11. Top of Body and Grate Finish: Stainless steel.
12. Top Shape: Round.
13. Top Loading Classification: No traffic.
14. Funnel: Not required.

C. Plastic Floor Sinks:
1. Standard: ASME A112.6.7.
2. Pattern: Floor drain.
3. Body Material: PVC.
4. Outlet: Bottom, PVC primer and solvent cement connection.
5. Sediment Bucket: Not required.
6. Internal Strainer: Flat.
7. Internal Strainer Material: PVC.
8. Top Grate Material: PVC.
9. Top Shape: Round.

10. Top Loading Classification: No traffic.
11. Funnel: Not required

2.4 TRENCH DRAINS

A. Trench Drains:
1. Standard: ASME A112.6.3 for trench drains.
2. Material: Ductile or gray iron.
3. Flange: Anchor
4. Clamping Device: Not required.
5. Outlet: Bottom.
6. Grate Material: Ductile iron.
7. Grate Finish: Not required.
8. Top Loading Classification: Heavy Duty.
9. Trap Material: Cast iron.
10. Trap Pattern: Standard P-trap.

2.5 CHANNEL DRAINAGE SYSTEMS

A. Stainless-Steel Channel Drainage Systems, ASME A112.3.1:
1. Description: Modular system of stainless-steel channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
2. Standard: ASME A112.3.1 for trench drains.
3. Channel Sections: Interlocking joint, stainless steel with level invert.

a. Dimensions: 5.8 inches wide.

4. Grates: Manufacturer's designation “heavy duty," with slots or perforations, and of width and thickness that fit recesses in channels.

a. Material: Stainless steel.
b. Locking Mechanism: Not required.

5. Covers: Solid stainless steel, of width and thickness that fit recesses in channels, and of lengths indicated.
6. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
7. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

B. Stainless-Steel Channel Drainage Systems, Non-ASME A112.3.1:
1. Description: Modular system of stainless-steel channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
2. Channel Sections: Interlocking joint, stainless steel with level invert.

a. Dimensions: 6 inches wide.

3. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channels.

a. Material: Stainless steel.
b. Locking Mechanism: Not required

4. Covers: Solid stainless steel, of width and thickness that fit recesses in channels, and of lengths indicated.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

C. Narrow, Sloped-Invert, Polymer-Concrete Channel Drainage Systems:
1. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
2. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps.

a. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated.
b. Include extension sections necessary for required depth.
c. Dimensions: 4-inch inside width. Include number of units required to form total lengths indicated.
d. Frame: Gray-iron or galvanized steel for grates.

3. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

a. Material: Stainless steel.

1) Locking Mechanism: Not required.

4. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

D. Narrow, Level-Invert, Polymer-Concrete Channel Drainage Systems:
1. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
2. Channel Sections: Narrow, interlocking-joint, precast, polymer-concrete modular units with end caps.

a. Include rounded bottom, with level invert and with NPS 4 outlets in number and locations indicated.
b. Dimensions: 5-inch inside width and 9-3/4 inches deep. Include number of units required to form total lengths indicated.

1) Frame: Gray-iron or galvanized steel for grates.

3. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

    a. Material: Ductile Iron.
    b. Locking Mechanism: Not required.

4. Covers: Solid ductile or gray iron of width and thickness that fit recesses in channel sections, and of lengths indicated.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

E. Wide, Level-Invert, Polymer-Concrete Channel Drainage Systems
1. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
2. Channel Sections: Wide, interlocking-joint, precast, polymer-concrete modular units with end caps.

    a. Include flat or rounded bottom, with level invert and with outlets in number, sizes, and locations indicated.
    b. Dimensions: 8-inch inside width and 13-3/4 inches deep. Include number of units required to form total lengths indicated.

        1) Frame: Gray-iron or galvanized steel for grates.

3. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

    a. Material: Ductile iron.
    b. Locking Mechanism: Not required.

4. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

F. FRP Channel Drainage Systems:
1. Description: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.
2. Channel Sections: Interlocking-joint, sloped-invert, FRP modular units, with end caps. Include flat, rounded, or inclined inside bottom, with outlets in number, sizes, and locations indicated.

    a. Dimensions: 6 or 8 inches wide. Include number of units required to form total lengths indicated.
    b. Frame: Manufacturer's standard metal for grates.

3. Grates: With slots or perforations and widths and thickness that fit recesses in channel sections.

    a. Material: Ductile Iron.
    b. Locking Mechanism: Not required.

4. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
5. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
6. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

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.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. 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.

D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install open drain fittings with top of hub 1 inch above floor.

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. 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.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial, atmospheric, gas-fired, storage, domestic-water heaters.
2. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
3. Commercial, power-vent, gas-fired, storage, domestic-water heaters.
4. Commercial, direct-vent, gas-fired, storage, domestic-water heater.
5. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
6. Gas-fired, tankless, domestic-water heaters.
7. Residential, atmospheric, gas-fired, storage, domestic-water heaters.
8. Residential, direct-vent, gas-fired, storage, domestic-water heaters.
9. Residential, power-vent, gas-fired, storage, domestic-water heaters.
10. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial, gas-fired, gas-fired, tankless, residential, gas-fired, commercial, oil-fired, residential, oil-fired, and commercial, gas- and oil-fired, domestic-water heater.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

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 use.
1. Component Importance Factor: 1.0.

B. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Storage-Tank Construction: Non-ASME-code steel with 150-psig working-pressure rating.
    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
        1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
        2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
    b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
4. Factory-Installed, Storage-Tank Appurtenances:
    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal with hose-end connection.
    d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
    g. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
5. Special Requirements: NSF 5 construction.
6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:
1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Storage-Tank Construction: Non-ASME-code steel with 150-psig working-pressure rating.
    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

4. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and natural-gas fuel.
g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
h. Temperature Control: Adjustable thermostat.
i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

C. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Storage-Tank Construction: Non-ASME-code steel with 150-psig working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

4. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
h. Temperature Control: Adjustable thermostat.
i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

5. Power-Vent System: Exhaust fan, interlocked with burner.

D. Commercial, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: ANSI Z21.10.1/CSA 4.1.
3. Storage-Tank Construction: Steel.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with ASHRAE/IES 90.1.
e. Jacket: Steel with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and natural-gas fuel.
h. Ignition: Standing pilot or ANSI Z21.20/CSA C22.2 No. 60730-2-5, electric, automatic, gas-ignition system.
i. Temperature Control: Adjustable thermostat.
j. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

5. Direct-Vent System: Through-wall, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.

E. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:
1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 84 percent combustion efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

5. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with ASHRAE/IES 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

F. Capacity and Characteristics:

1. Capacity: 40 gal..
2. Recovery: 36 gph at 90 deg F temperature rise.
3. Temperature Setting: 125 deg F.

4. Fuel Gas Input: 36 Btu/h.
5. Gas Pressure Regulator: Per Manufacturer's recommendation.
6. Minimum Vent Diameter: 6 inches.

Commented [A1]: Not sure how to address this one? We don't know existing gas pressure, and req'd gas pressure of the heater

Commented [A2R1]: Addressed per 4/3 conversation

2.3 RESIDENTIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Residential, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
   1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
   2. Standard: ANSI Z21.10.1/CSA 4.1.
   3. Storage-Tank Construction: Steel.
      a. Tappings: ASME B1.20.1 pipe thread.
      b. Pressure Rating: 150 psig.
      c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
   4. Factory-Installed, Storage-Tank Appurtenances:
      a. Anode Rod: Replaceable magnesium.
      b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
      c. Drain Valve: Corrosion-resistant metal with hose-end connection.
      d. Insulation: Comply with ASHRAE/IES 90.1.
      e. Jacket: Steel with enameled finish.
      f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
      g. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas fuel.
      h. Temperature Control: Adjustable thermostat.
      i. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
   5. Draft Hood: Low-profile-type draft diverter, complying with ANSI Z21.12.

B. Residential, Direct-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
   1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
   2. Standard: ANSI Z21.10.1/CSA 4.1.
   3. Storage-Tank Construction: Steel.
      a. Tappings: ASME B1.20.1 pipe thread.
      b. Pressure Rating: 150 psig.
      c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
   4. Factory-Installed, Storage-Tank Appurtenances:
      a. Anode Rod: Replaceable magnesium.

b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with **ASHRAE/IES 90.1**.
e. Jacket: Steel with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Burner: For use with direct-vent, gas-fired, domestic-water heaters and **natural-gas** fuel.
h. Temperature Control: Adjustable thermostat.
i. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

5. Direct-Vent System: Through-**wall**, coaxial- or double-channel vent assembly with domestic-water heater manufacturers' outside intake/exhaust screen.

C. Residential, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
1. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
2. Standard: ANSI Z21.10.1/CSA 4.1.
3. Storage-Tank Construction: Steel.

a. Tappings: ASME B1.20.1 pipe thread.
b. Pressure Rating: 150 psig.
c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

4. Factory-Installed, Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal with hose-end connection.
d. Insulation: Comply with ASHRAE/IES 90.1.
e. Jacket: Steel with enameled finish.
f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
g. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
h. Temperature Control: Adjustable thermostat.
i. Combination Temperature-and-Pressure Relief Valve: ANSI Z21.22/CSA 4.4. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

5. Power-Vent System: Exhaust fan, interlocked with burner.

D. Capacity and Characteristics:

1. Capacity: 40 gal..
2. Recovery: 36 gph at 90 deg F temperature rise.

Commented [A3]: I think we need to add a new "D" for tankless water heaters. We have called out a tankless water heater on the design prints.

Commented [A4R3]: Tankless water heater section taken from full construction spec and added. Custom inputs marked in red. Suggested removal marked in strikethrough.

3. Temperature Setting: 125 deg F.
4. Fuel Gas Input: 36 Btu/h.
5. Gas Pressure Regulator: Per Manufacturer’s recommendation.

6. Minimum Vent Diameter: 6 inches.

2.4 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

A. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

B. Standard: ANSI Z21.10.3/CSA 4.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.

C. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.

1. Tappings: ASME B1.20.1 pipe thread.
2. Pressure Rating: 150 psig (1035 kPa).
3. Heat Exchanger: Copper tubing.
4. Insulation: Comply with ASHRAE/IES 90.1 or ASHRAE 90.2.
5. Jacket: Metal, with enameled finish, or plastic.
6. Burner: For use with tankless, domestic-water heaters and natural gas fuel.
7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
8. Temperature Control: Adjustable thermostat.

D. Support: Bracket for wall mounting.

E. Capacity and Characteristics:

1. Flow Rate: 6.6 gpm at 0-30 deg F temperature rise.
2. Fuel Gas Input: 15,000-120,000 BTU/H
3. Gas Pressure Regulator: Per Manufacturer’s recommendation.
4. Electrical Characteristics:

   a. Volts: **120** Volts.
   b. Phase: Single.
   c. Hertz: 60 Hz.

5. Minimum Vent Diameter: 3 inches.

2.5 DOMESTIC-WATER HEATER ACCESSORIES

A. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

B. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

C. Heat-Trap Fittings: ASHRAE 90.2.

D. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1, manually operated. Furnish for installation in piping.

E. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

F. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

G. Pressure Relief Valves: Include pressure setting less than working-pressure rating of domestic-water heater.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

I. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Provide dimension that will support bottom of domestic-water heater minimum of 18 inches above the floor.

J. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.6 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on floor.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

C. Install domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Install gas-fired, domestic-water heaters in accordance with NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

E. Install oil-fired, domestic-water heaters in accordance with NFPA 31.

1. Install shutoff valves on fuel-oil supply piping to oil-fired water-heater burners without shutoff valves. Comply with requirements for shutoff valves specified in Section 231113 "Facility Fuel-Oil Piping."

F. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

G. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend domestic-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

H. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

I. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

K. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

L. Fill domestic-water heaters with water.

M. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections

B. 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 operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION 223400

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Floor-mounted, bottom-outlet water closets.
2. Floor-mounted, back-outlet water closets.
3. Wall-mounted water closets.
4. Flushometer valves.
5. Toilet seats.
6. Supports.

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.4 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.

B. Sustainable Design Submittals:

1. Product Data: For water consumption

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

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: 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. Toilet Seat

3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.

4. Flushometer Valve

B. Water Closets, Floor Mounted, Bottom Outlet, Back 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.
f. Rim Contour: Elongated.

2. Water Consumption: 1.28 gal. per flush.

a. Spud Size and Location: NPS 1-1/2; back.
b. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.

4. Toilet Seat

5. Flushometer Valve

C. Water Closets, Floor Mounted, Bottom Outlet, Close-Coupled Flushometer Tank:
1. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASSE/ASME 1037/CSA B125.37.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Pressure assisted.
e. Height: Handicapped/elderly, complying with ICC/ANSI A117.1.
f. Rim Contour: Elongated.
g. Water Consumption: Maximum 1.28 gal per flush.
h. Color: White.

2. Toilet Seat

3. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
4. Flushometer Tank: Pressure assisted.
5. Toilet Seat

2.2 FLOOR-MOUNTED, BACK-OUTLET WATER CLOSETS

A. Water Closets, Floor Mounted, Back 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.
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. Toilet Seat
3. Support: Water closet carrier.
4. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.
5. Flushometer Valve

B. Water Closets, Floor Mounted, Back Outlet, Back 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.
f. Rim Contour: Elongated.
g. Water Consumption: 1.28 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; back.
i. Color: White.

2. Flushometer Valve.
3. Toilet Seat.

C. Water Closets, Floor Mounted, Back Outlet, Close-Coupled Flushometer Tank:
1. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASSE/ASME 1037/CSA B125.37.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Pressure assisted.
e. Height: Handicapped/elderly, complying with ICC/ANSI A117.1.
f. Rim Contour: Elongated.
g. Water Consumption: Maximum 1.28 gal per flush.
h. Color: White.

2. Bowl-to-Drain Connecting Fitting: ASTM A1045 or ASME A112.4.3.
3. Flushometer Tank: Pressure assisted.
4. Toilet Seat.

2.3 WALL-MOUNTED WATER CLOSETS

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. Flushometer Valve.
3. Toilet Seat.
4. Support: Water closet carrier.
5. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

B. Water Closets, Wall Mounted, Back 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; back.

2. Flushometer Valve.
3. Toilet Seat.
4. Support: Water closet carrier.
5. Water-Closet Mounting Height: Handicapped/elderly according to ICC A117.1.

2.4 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:
1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig (860 kPa).
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. Consumption: 1.28 gal. per flush.
8. Minimum Inlet: NPS 1.
9. Minimum Outlet: NPS 1-1/4.

B. 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: Hard-wired 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.

C. Motor-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: Geared-motor actuator 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: Hard-wired 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.

D. Hydraulic-Actuator, Push-Button, 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. Consumption: 1.28 gal. per flush.
8. Minimum Inlet: NPS 1.
9. Minimum Outlet: NPS 1-1/4.

E. Lever-Handle, Piston 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. Consumption: 1.28 gal. per flush.
8. Minimum Inlet: NPS 1.
9. Minimum Outlet: NPS 1-1/4.

F. Hard-Wired, Solenoid-Actuator, Piston 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: Hard-wired 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.

G. Battery-Powered, Solenoid-Actuator, Piston 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. Standard: IAPMO/ANSI Z124.5.
2. Material: Plastic.
3. Type: Commercial (Standard).
4. Shape: Elongated rim, open front.
5. Hinge: Check.
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White.

2.6 SUPPORTS

A. Water Closet Carrier:
1. Standard: ASME A112.6.1M.
2. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture.

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 walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

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. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. 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 lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. 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.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Service sinks.
2. Kitchen/utility sinks.
3. Manually operated sink faucets.
4. Supply fittings.
5. Waste fittings.
6. Sink supports.
7. Grout.

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 sinks.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
1. Product Data: For water consumption.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted sinks.

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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE SINKS

A. Service Sinks - Plastic, Floor Mounted:
1. Source Limitations: Obtain sinks from single source from single manufacturer.
2. Fixture:

a. Standard: CSA B45.5/IAPMO Z124.
b. Material: Molded polymer.
c. Nominal Size: 24 by 24 by 10 inches.
d. Rim Guard: On all top surfaces.
e. Color: Not applicable.
f. Drain: Grid with NPS 2 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet.

2.2 KITCHEN/UTILITY SINKS

A. Kitchen/Utility Sinks - Stainless Steel, Counter Mounted:
1. Source Limitations: Obtain sinks from single source from single manufacturer.
2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Stainless steel, self-rimming, sound-deadened unit.
c. Number of Compartments: Two.
d. Overall Dimensions: 25” x 19”.
e. Material: 22 gauge minimum, Type 300 series stainless steel.

f. Each Compartment:

1) Dimensions: 10” x 14”
2) Drains: Grid with NPS 1-1/2 tailpiece and twist drain
3) Drain Location: Centered in compartment.
4) Depth: Standard.

3. Faucet(s):

a. Number Required: One.
b. Mounting: On ledge.

4. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.

2) Risers: NPS 1/2, ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

5. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):

1) Size: NPS 1-1/2.
2) Material:

a) Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

c. Continuous Waste:

1) Size: NPS 1-1/2.
2) Material: Chrome-plated, 17-gauge brass tube.

6. Mounting: On counter with sealant.

2.3 MANUALLY OPERATED SINK FAUCETS

A. Sink faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Commercial Sink Faucets - Manual Type: Two-handle mixing.
1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Centerset or Widespread.
5. Body Material: Commercial, solid brass, or die-cast housing with brazed copper and brass waterway.
6. Finish: Chrome plated.
7. Maximum Flow Rate Required: 1.5 gpm.
8. Mounting Type: Deck, concealed.
9. Valve Handle(s): 6-inch wrist blade.
10. Spout Type: Swivel gooseneck.
11. Vacuum Breaker: Not required for hose outlet.
12. Spout Outlet: Plain end.

C. Commercial Service Sink Faucets - Manual Type:
1. Source Limitations: Obtain sink faucets from single source from single manufacturer.
2. Description: Wall/back mounted, brass body, with integral service stops, checks, spout with bucket/pail hook, 3/4-inch hose thread end, integral vacuum breaker, inlets 8 inches o.c., and two-handle mixing.

3. Faucet:

    a. Standards:

        1) ASME A112.18.1/CSA B125.1.
        2) NSF 61 and NSF 372.
        3) ICC A117.1.
        4) ASSE 1001 (VB).

    b. Finish: Rough chrome plated.
    c. Handles: Lever 4 arms.
    d. Cartridges: One-fourth turn compression.
    e. Brace: Adjustable top brace.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation:Wheel handle.

F. Risers:

1. NPS 1/2.
2. ASME A112.18.6/CSA B125.6, braided or corrugated stainless steel flexible hose.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.
2. Material:

    a. Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17-gauge brass tube to wall; and chrome-plated brass or steel wall flange.

2.6 SINK SUPPORTS

A. Sink Carrier:
1. Source Limitations: Obtain sink supports from single source from single manufacturer.
2. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb in accordance with rough-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install wall-mounted sinks at accessible mounting height in accordance with ICC A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. 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."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 224713 - DRINKING FOUNTAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Drinking fountains.
2. Bottle filling stations.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain and bottle filling station.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include operating characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:
1. Product Data: For water consumption.

C. Shop Drawings:

1. Include diagrams for power wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For **drinking fountains and bottle filling stations** 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. Filter Cartridges: Equal to **10** percent of quantity installed for each type and size indicated, but no fewer than **1** of each.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Drinking fountains and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
2. **Comply with ASME A112.19.3/CSA B45.4 for stainless steel drinking fountains and bottle filling stations.**
3. Comply with NSF 42 and NSF 53 for water filters for drinking fountains and bottle filling stations.
4. Comply with ICC A117.1 for accessible drinking fountains and bottle filling stations.

2.2 DRINKING FOUNTAINS

A. BASIS OF DESIGN: **Zurn Elkay EZSTL8WSLK or approved equal**

2.3 SUPPORTS

A. Drinking Fountain Carrier:
1. 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 fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains and bottle filling stations on flat surface in accordance with manufacturer's written installation instructions.

C. Install recessed, drinking fountains and bottle filling stations secured to wood blocking in wall construction.

D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation.

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings.

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture.

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224713

SECTION 233713.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Linear bar diffusers.
6. Linear slot diffusers.
7. Ceiling-integral continuous slot diffusers.
8. Light troffer diffusers.
9. Round induction underfloor air-distribution diffusers.
10. Linear underfloor air-distribution diffuser plenums.
11. High-capacity drum louver diffusers.
12. High-capacity, modular-core supply grille diffusers.

B. Related Requirements:
1. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Actual size of smallest diffuser indicated.

C. Samples for Initial Selection: For diffusers with factory-applied color finishes. Actual size of smallest diffuser indicated.

D. Samples for Verification: For diffusers, in manufacturer's standard sizes to verify color selected. Actual size of smallest diffuser indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 ROUND CEILING DIFFUSERS

A. Devices shall be specifically designed for variable-air-volume flows.

B. Material: Steel.

C. Finish: Baked enamel, white.

D. Face Style: Four cone.

E. Mounting: Duct connection.

F. Pattern: Fully adjustable.

G. Dampers: Radial opposed blade.

H. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

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: Three cone.

F. Mounting: Surface.

G. Pattern: Adjustable.

H. Dampers: Radial opposed blade.

I. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

2.3 PERFORATED DIFFUSERS

A. Devices shall be specifically designed for variable-air-volume flows.

B. Material: Steel backpan and pattern controllers, with steel face.

C. Finish: Baked enamel, white.

D. Face Size: 12 by 12 inches

E. Duct Inlet: Round.

F. Face Style: Flush.

G. Mounting: Surface.

H. Pattern Controller: Four louvered deflector patches.

I. Dampers: Opposed blade.

J. Accessories:

1. Equalizing grid.
2. Plaster ring.
3. Safety chain.
4. Wire guard.
5. Sectorizing baffles.
6. Operating rod extension.

2.4 LOUVER FACE DIFFUSERS

A. Devices shall be specifically designed for variable-air-volume flows.

B. Material: Steel.

C. Finish: Baked enamel, white.

D. Face Size: 12 inches.

E. Mounting: Surface.

F. Pattern: One-way core style.

G. Dampers: Radial opposed blade.

H. Accessories:

1. Square to round neck adaptor.
2. Adjustable pattern vanes.
3. Throw reducing vanes.
4. Equalizing grid.
5. Plaster ring.
6. Safety chain.
7. Wire guard.
8. Sectorizing baffles.
9. Operating rod extension.

2.5 LINEAR BAR DIFFUSERS

A. Devices shall be specifically designed for variable-air-volume flows.

B. Material: Steel.

C. Finish: Baked enamel, white.

D. Narrow Core Spacing Arrangement: 1/8-inch- thick blades spaced 1/4 inch apart; 15-degree deflection.

E. Frame: 1-1/4 inches wide.

F. Mounting Frame: Filter.

G. Mounting: Countersunk screw.

H. Damper Type: Adjustable opposed-blade assembly.

I. Accessories: Directional vanes.

2.6 LINEAR SLOT DIFFUSERS

A. Devices shall be specifically designed for variable-air-volume flows.

B. Material - Shell: Steel.

C. Material - Pattern Controller and Tees: Aluminum.

D. Finish - Face and Shell: Baked enamel.

E. Finish - Pattern Controller: Baked enamel.

F. Finish - Tees: Baked enamel.

G. Slot Width: 1/2 inch.

H. Number of Slots: Two.

I. Length: 24 inches.

J. Accessories: T-bar slot.

2.7 CEILING-INTEGRAL CONTINUOUS DIFFUSERS

A. Slot Width: 1 inch.

B. Section Length: 12 feet.

C. Straight and curved sections as required to accommodate layout.

D. Pattern Controllers: 24 inches o.c.

E. Material: Aluminum, extruded, heavy wall.

F. Finishes:

1. Exterior: Standard white.
2. Interior: Standard black.

G. Throw: Standard.

H. Mounting: Ceiling.

I. Plenum: Noninsulated.

J. Other Features:

1. Painted interior.
2. Blank-offs.

2.8 LIGHT TROFFER DIFFUSERS

A. Devices shall be specifically designed for variable-air-volume flows.

B. Material: Steel.

C. Finish: None.

D. Slot Width: 1/2 inch.

E. Number of Sides: One.

F. Length: 24 inches.

G. Pattern: Fixed.

H. Inlet: Side.

I. Inlet Size: 6 inches.

2.9 ROUND INDUCTION UNDERFLOOR AIR-DISTRIBUTION DIFFUSERS

A. Airflow Principle: Swirl-pattern induction.

B. Material: Plastic, high impact, and resistant to cart and foot traffic.

C. Color: Gray.

D. Components:

1. Diffuser core.
2. Flow regulator.
3. Dirt and liquid catch pan.
4. Spacer flange.
5. Gasketed, underfloor compression ring.

2.10 LINEAR UNDERFLOOR AIR-DISTRIBUTION DIFFUSER PLENUMS

A. Material: Steel.

B. Finish: White baked acrylic.

C. Deflection: 15 degrees.

D. Components:

1. Aluminum diffuser core.
2. Diffuser frame.
3. Plenum, 0.034-inch steel.

2.11 HIGH-CAPACITY DRUM LOUVER DIFFUSERS

A. Airflow Principle: Extended distance for high airflow rates.

B. Material: Aluminum, heavy gage extruded.

C. Finish: White baked acrylic.

D. Border: 1-1/4-inch width with countersunk screw holes.

E. Gasket between drum and border.

F. Body: Drum shaped; adjustable vertically.

G. Blades: Individually adjustable horizontally.

H. Mounting: Surface to duct.

I. Inlet Width: 6 inches.

J. Inlet Length: 12 inches.

K. Accessories:

1. Opposed-blade steel damper.
2. Duct-mounting collars with countersunk screw holes.

2.12 HIGH-CAPACITY, MODULAR-CORE SUPPLY GRILLE DIFFUSERS

A. Throw: Extended distance for airflow rates.

B. Material: Steel.

C. Grilles per Unit: Two.

D. Finish: White baked acrylic.

E. Border: 1-1/2-inch width with countersunk screw holes.

F. Blades:

1. Airfoil, individually adjustable horizontally.
2. Double deflection.
3. Set in modules.

G. Modules: Removable; rotatable.

H. Mounting: Surface.

I. Accessory: Opposed-blade steel damper.

2.13 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

SECTION 233713.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adjustable blade face registers and grilles.
2. Fixed face registers and grilles.
3. Linear bar grilles.

B. Related Requirements:
1. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified. Smallest size register and grille indicated.

C. Samples for Initial Selection: For registers and grilles with factory-applied color finishes. Smallest size register and grille indicated.

D. Samples for Verification: For registers and grilles, in manufacturer's standard sizes to verify color selected. Smallest size register and grille indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

B. Source quality-control reports.

PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register:
1. Material: Steel.
2. Finish: Baked enamel, white.
3. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
4. Core Construction: Integral.
5. Frame: 1-1/4 inches wide.
6. Mounting: Countersunk screw.
7. Damper Type: Multishutter
8. Accessories:

a. Front blade gang operator.
b. Filter.

B. Fixed 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. Frame: 1-1/4 inches wide.
6. Mounting: Countersunk screw.
7. Damper Type: Multishutter.
8. Accessory: Filter.

2.2 GRILLES

A. Adjustable Blade Face Grille:
1. Material: Steel.
2. Finish: Baked enamel, white.
3. Face Blade Arrangement: Horizontal spaced 1/2 inch apart.
4. Core Construction: Integral.
5. Frame: 1-1/4 inches wide.
6. Mounting: Countersunk screw.
7. Accessories:

a. Front-blade gang operator.
b. Filter.

B. Fixed Face Grille:
1. Material: Steel.
2. Finish: Baked enamel, white.
3. Face Blade Arrangement: Horizontal; spaced 1/2 inch.
4. Face Arrangement: Perforated core.
5. Core Construction: Integral.
6. Frame: 1-1/4 inches wide.
7. Mounting: Countersunk screw.

8. Accessory: Filter.

C. Linear Bar Grilles
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. Distribution plenum.

a. Internal insulation.
b. Inlet damper.

7. Frame: 1-1/4 inches wide.
8. Mounting: Countersunk screw.
9. Damper Type: Adjustable opposed blade

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 235416.13 - GAS-FIRED FURNACES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gas-fired furnaces and accessories complete with controls.
2. Air filters.
3. Air cleaners.
4. UV germicidal lights.
5. Humidifiers.
6. Ventilation heat exchangers.
7. Refrigeration components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each furnace 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. Furnace and accessories complete with controls.
b. Air filter.
c. Air cleaner.
d. UV germicidal light.
e. Humidifier.

f. Ventilation heat exchanger.
g. Refrigeration components.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Disposable Air Filters: Furnish two complete sets.
2. Fan Belts: Furnish one set(s) for each furnace fan.

1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup.

B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

C. Comply with NFPA 70.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:

a. Furnace Heat Exchanger: 10 years.
b. Integrated Ignition and Blower Control Circuit Board: Five years.
c. Draft-Inducer Motor: Five years.
d. Refrigeration Compressors: 10 years.
e. Evaporator and Condenser Coils: Five years.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.

B. General Requirements for Noncondensing Gas-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

2.2 GAS-FIRED FURNACES, NONCONDENSING

A. Cabinet: Steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.

B. Fan: Centrifugal, factory balanced, resilient mounted, direct or belt drive

C. Type of Gas: Natural.

D. Heat Exchanger: Aluminized steel.

E. Burner:

1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

F. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

G. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

H. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; and adjustable fan-on and fan-off timing; terminals for connection to accessories.

I. Vent Materials: Comply with requirements in Section 235123 "Gas Vents" for Type B metal vents.

J. Capacities and Characteristics:

1. Airflow Configuration: Upflow.
2. Gas:

a. Type: Natural.
b. Venting Type: Power venter.
c. Minimum Efficiency AFUE: 80 percent.
d. Input: <66,000 MBh.
e. Heat Output: 53,000 MBh.
f. Gas Connection Size: 1/2 NPS.
g. Vent Size: 4 inches.

3. Fan:

    a. Airflow: 1500 cfm .
    b. External Static Pressure: 0.5 inches wg.
    c. Motor:

        1) Size: 3/4 hp.
        2) Speed: 1050.

    d. Volts: 120V.
    e. Phase: 1.
    f. Hertz: 60.

4. Furnace Electrical Connection:

    a. Volts: 120V.
    b. Phase: 1.
    c. Hertz: 60.

2.3 GAS-FIRED FURNACES, CONDENSING

A. Cabinet: Steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.

B. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

C. Type of Gas: Natural.

D. Heat Exchanger:

1. Primary: Aluminized steel.
2. Secondary: Polyethylene-coated steel.

E. Burner:

1. Gas Valve: 100 percent safety two-stage main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

F. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

G. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

H. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories.

I. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall.
2. CPVC Plastic Vent Materials:

    a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F441/F441M.
    b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F438, socket type.
    c. CPVC Solvent Cement: ASTM F493.

3. PVC Plastic Vent Materials:

    a. PVC Plastic Pipe: Schedule 40, complying with ASTM D1785.
    b. PVC Plastic Fittings: Schedule 40, complying with ASTM D2466, socket type.
    c. PVC Solvent Cement: ASTM D2564.

J. Capacities and Characteristics:

1. Airflow Configuration: Upflow.
2. Gas:

    a. Type: Natural.
    b. Venting Type: Power venter.
    c. Minimum Efficiency AFUE: 80 percent.
    d. Input: <66,000 MBh.
    e. Heat Output: 53,000 MBh.
    f. Gas Connection Size: 1/2 NPS.
    g. Vent Size: 4 inches.

3. Fan:

    a. Airflow: 1500 cfm .
    b. External Static Pressure: 0.5 inches wg.
    c. Motor:

        1) Size: 3/4 hp.
        2) Speed: 1050.

    d. Volts: 120V.
    e. Phase: 1.
    f. Hertz: 60.

4. Furnace Electrical Connection:

a. Volts: 120V.
b. Phase: 1.
c. Hertz: 60.

2.4 THERMOSTATS

A. Controls shall comply with requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air Conditioning."

B. Solid-State Thermostat: Wall-mounted, programmable, microprocessor-based unit with manual switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day, and battery backup protection against power failure for program settings.

2.5 AIR FILTERS

A. Washable Filters: 1-inch-thick urethane pad.

B. Disposable Filters: 1-inch-thick fiberglass media in sheet metal frame.

C. Charged Media Air Filters: Sheet metal housing arranged to be ducted in return-air duct connection to furnace; generates electrostatic charge; MERV 10 rating.

D. HEPA Air Filter Units: Sheet metal housing with fan arranged to be ducted to return-air duct connection to furnace, with activated carbon prefilter and high-efficiency particulate air (HEPA) disposable filter. HEPA shall be as follows:

1. Standard: UL 586.
2. Rating: ASHRAE 52.2, 99.97 percent efficiency to 0.30-micrometer particle size.

2.6 VENTILATION AIR HEAT EXCHANGERS

A. Cabinet: Steel, with factory-installed interior insulation and manufacturer's standard factory finish. Fabricate with space for piping and electrical conduits.

B. Heat-Recovery Device: Fixed-plate, polypropylene copolymer (high-density plastic) heat-exchanger plates evenly spaced and sealed and arranged for counter airflow.

C. Supply and Exhaust Fans: Forward curved centrifugal with direct drive. Motors comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

D. Filters: 1-inch-thick disposable type, in galvanized-steel frame, mounted upstream of unit in both supply and exhaust airstreams.

E. Wiring: Wire motors and controls so only external connections are required during installation.

2.7 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IES 90.1.

B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with AHRI 210/240. Match size with furnace. Include condensate drain pan with accessible drain outlet.

1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I, 1/2 inch thick.

D. Refrigerant Piping: Comply with requirements in Section 232300 "Refrigerant Piping."

E. Air-Cooled Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, 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 reciprocating or scroll type.

a. Crankcase heater.
b. Restrained vibration isolation mounts for compressor.
c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
e. Refrigerant: R-407C or R-410A.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with liquid subcooler.
4. Heat-Pump Components: Reversing valve and low-temperature air cut-off thermostat.
5. Fan: Aluminum-propeller type, directly connected to motor.
6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permits operation down to 45 deg F.
8. Mounting Base: Polyethylene.

F. Capacities and Characteristics:

1. Refrigerant Coil:

a. Total Cooling Capacity: 36000 Btu/h.
b. Maximum Air Pressure Drop: 0.19 inches wg.
c. Condensate Drain Size: 1-1/4 NPS.

2. Compressor-Condenser Unit:

a. Cooling Energy Efficiency (SEER):
b. Volts: 208.
c. Phase: 1.
d. Hertz: 60.
e. Minimum Circuit Ampacity: 17.9
f. Maximum Overcurrent Protection: 30.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for gas[and refrigerant] piping systems to verify actual locations of piping connections before equipment installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

D. Controls: Install thermostats and humidistats at mounting height of 60 inches above floor.

E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

F. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit. Coordinate anchor installation with concrete base.

3.3 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent Connection, Noncondensing, Gas-Fired Furnaces: Connect Type B vents to furnace vent connection and extend outdoors.

D. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

    a. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. CPVC Piping: Join according to ASTM D2846/D2846M, Appendix.
    c. PVC Pressure Piping: Join schedule number ASTM D1785 PVC pipe and PVC socket fittings according to ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D2855.

4. Slope pipe vent back to furnace or to outside terminal.

E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled compressor-condenser unit.

1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
2. Soldered Joints: Apply ASTM B813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B32.
3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

F. Comply with requirements in Section 232300 "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.4 DUCTWORK CONNECTIONS

A. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.6 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casings.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Adjust fan belts to proper alignment and tension.

C. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

D. Measure and record airflows.

E. Verify proper operation of capacity control device.

F. After startup and performance test, lubricate bearings.

3.7 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.8 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform electrical test and visual and mechanical inspection.

2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 235416.13

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Equipment stands.
10. Equipment supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 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. Stainless Steel Pipe Hangers and Supports:

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

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.

2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.3 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.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.
3. Flammability: ASTM D635, ASTM E84, and UL 94.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.

    a. Flammability: ASTM D635, ASTM E84, and UL 94.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.5 PLASTIC PIPE HANGERS

A. Description: Similar to MSS SP-58, Types 1 through 58, factory-fabricated steel pipe hanger except hanger is made of plastic.

B. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

C. Flammability: ASTM D635, ASTM E84, and UL 94.

2.6 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
7. Metallic Coating: Hot-dip galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:
   1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
   2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   3. Channels: Continuous slotted carbon-steel channel with inturned lips.
   4. Channel Width: Select for applicable load criteria.
   5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
   6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.
   7. Metallic Coating: Hot-dip galvanized.

2.7 FIBERGLASS STRUT SYSTEMS

A. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.

   1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
   2. Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.
   3. Channel Width: Selected for applicable load criteria.
   4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
   5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
   6. Rated Strength: Selected to suit applicable load criteria.
   7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.9 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 or stainless steel.
   2. Outdoor Applications: Stainless steel.

2.10 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:
   1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
   2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   3. Hardware: Galvanized steel or polycarbonate.
   4. Accessories: Protection pads.

C. Low-Profile, Single Base, Single-Pipe Stand:
   1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
   2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
   3. Vertical Members: Two, galvanized-steel, continuous-thread 1/2-inch rods.
   4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
   5. Pipe Supports: Strut clamps.
   6. Hardware: Galvanized steel.
   7. Accessories: Protection pads.
   8. Height: 12 inches above roof.

D. High-Profile, Single Base, Single-Pipe Stand:
   1. Description: Single base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
   2. Base: Single vulcanized rubber or molded polypropylene.
   3. Vertical Members: Two, galvanized-steel, continuous-thread 1/2-inch rods.
   4. Horizontal Member: One, adjustable height, galvanized-steel pipe support slotted channel or plate.
   5. Pipe Supports: Clevis hanger.
   6. Hardware: Galvanized steel.
   7. Accessories: Protection pads, 1/2-inch continuous-thread galvanized-steel rod.

E. High-Profile, Multiple-Pipe Stand:
   1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
   2. Bases: Two or more; vulcanized rubber.
   3. Vertical Members: Two or more, galvanized-steel channels.
   4. Horizontal Members: One or more, adjustable height, galvanized-steel pipe support.

5. Pipe Supports: Strut clamps.
6. Hardware: Galvanized steel.
7. Height: 36 inches above roof.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.11 EQUIPMENT SUPPORTS

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

2.12 OUTDOOR EQUIPMENT STANDS

1. Description: Individual foot supports with elevated adjustable channel cross bars and clamps/fasteners/bolts for ground or roof supported outdoor equipment components, without roof membrane penetration, in a pre-fabricated system that can be modularly-assembled on site.
2. Foot Material: Rubber or polypropylene.
3. Rails Material: Hot dip galvanized carbon steel.
4. Wind/Sliding Load Resistance: Up to 100 mph minimum.

2.13 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011/A1011M.

C. Structural Steel: ASTM A36/A36M, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240/A240M.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. 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. 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.

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 the 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. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

F. 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.

G. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. 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.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. 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.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. 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.

O. 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. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 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 A780/A780M.

3.7 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 finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing systems and attachments for general service applications.

F. Use stainless steel pipe hangers, and fiberglass pipe hangers, and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. 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. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. 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.
5. 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.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.

9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-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.

N. 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.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1.2 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:

    a. Constant-volume air systems.
    b. Dual-duct systems.
    c. Variable-air-volume systems.
    d. Multizone systems.
    e. Induction-unit systems.

2. Testing, Adjusting, and Balancing of Hydronic Piping Systems:

    a. Constant-flow hydronic systems.
    b. Variable-flow hydronic systems.
    c. Primary-secondary hydronic systems.

3. Testing, adjusting, and balancing of fuel oil systems for HVAC.
4. Testing, adjusting, and balancing of steam and condensate piping systems.
5. Testing, adjusting, and balancing of equipment.
6. Testing, adjusting, and balancing of existing HVAC systems and equipment.
7. Procedures for exhaust hoods.
8. Sound tests.
9. Vibration tests.
10. Duct leakage tests verification.
11. Pipe leakage tests verification.
12. UFAD plenum leakage tests verification.
13. HVAC-control system verification.
14. Smoke-control system tests.
15. Stair-pressurization system tests.
16. Elevator-pressurization system tests.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

G. UFAD: Underfloor air distribution.

1.4 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. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by AABC:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC.

B. TAB Specialists Qualifications, Certified by NEBB or TABB:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

E. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.

F. Examine equipment performance data, including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

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 terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.

L. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

Q. 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.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials.

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 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Motors.
2. Fans and ventilators.
3. Terminal units.
4. Furnaces.
5. Radiant heaters.
6. Unit heaters.
7. Condensers.
8. Air-handling units.
9. Heating and ventilating units.
10. Heating-only makeup air units.
11. Dedicated outdoor-air units.
12. Packaged air conditioners.
13. Split-system air conditioners.
14. Variable-refrigerant-flow systems.
15. Valance heating and cooling units.
16. Radiant-heating cables, piping, and panels.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
    c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

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 Contractor-prepared shop drawings and Record drawings 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 Owner 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, speed, 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.

3.7 PROCEDURES FOR DUAL-DUCT SYSTEMS

A. Adjust the dual-duct systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge. On systems with separate hot-deck and cold-deck fans, verify the location of the sensor on each deck.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point, so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's

recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.

4. Calibrate and balance each terminal unit's hot deck and cold deck for maximum and minimum design airflow as follows:

    a. Adjust controls so that terminal is calling for full cooling. Some controllers require starting with minimum set point. Verify calibration procedure for specific project.
    b. Measure airflow and adjust calibration factors as required for design cold-deck maximum airflow and hot-deck minimum airflow. Record calibration factors.
    c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    d. Adjust controls so that terminal is calling for full heating.
    e. Measure airflow and adjust calibration factors as required for design cold-deck minimum airflow and hot-deck maximum airflow. Record calibration factors. If no minimum calibration is available, note any deviation from design airflow.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    b. Set terminals for maximum airflow. If system design includes diversity (cooling coil or fan), adjust terminals for maximum and minimum airflow so that connected total matches cooling coil or fan selection and simulates actual load in the building. In systems with separate hot-deck and cold-deck fans, diversity consideration applies to each individual fan.
    c. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
    d. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

6. Measure the fan(s) static pressures as follows:

    a. Measure static pressure directly at the fan outlet or through the flexible connection.
    b. Measure static pressure directly at the fan inlet or through the flexible connection.
    c. Measure static pressure across each component that makes up the air-handling system.
    d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan(s) while operating at maximum return airflow and minimum outdoor airflow.

    a. Balance the return-air ducts and inlets.
    b. Verify that all terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit, and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls Contractor.

9. Verify final system conditions as follows:

    a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
    b. Re-measure and confirm that total airflow is within design.
    c. Re-measure final fan operating data, speed, volts, amps, and static profile.
    d. Mark final settings.
    e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
    f. Verify tracking between supply and return fans.

10. Record final fan-performance data.

3.8 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

    a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
    b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
    c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
    d. Adjust controls so that terminal is calling for minimum airflow.
    e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
    f. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

    a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.

b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow, so that connected total matches fan selection and simulates actual load in the building.
c. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
d. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

6. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Balance the return-air ducts and inlets.
b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit, and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls Contractor.
9. Verify final system conditions as follows:

a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
b. Re-measure and confirm that total airflow is within design.
c. Re-measure final fan operating data, speed, volts, amps, and static profile.
d. Mark final settings.
e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
f. Verify tracking between supply and return fans.

3.9 PROCEDURES FOR MULTIZONE SYSTEMS

A. Position the unit's automatic zone dampers for maximum flow through the cooling coil.

B. The procedures for multizone systems will utilize the zone balancing dampers to achieve the indicated airflow within the zone.

C. After balancing, place the unit's automatic zone dampers for maximum heating flow. Retest zone airflows and record any variances.

D. 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 main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
    c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

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 drawings 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 Owner 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.

E. 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.

F. 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 inlet and outlet airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

G. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, 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.

3.10 PROCEDURES FOR INDUCTION-UNIT SYSTEMS

A. Balance primary-air risers by measuring static pressure at the nozzles of the top and bottom units of each riser, to determine which risers must be throttled. Adjust risers to indicated airflow within specified tolerances.

B. Adjust each induction unit.

C. 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 main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
    c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

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 drawings 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 Owner 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.

D. 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.

E. Balance airflow to each induction unit by measuring the nozzle pressure and comparing it to the manufacturer's published data for nozzle pressure versus cfm. Adjust the unit's inlet damper to achieve the required nozzle pressure for design cfm.

F. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speeds, 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.

3.11 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.12 PROCEDURES FOR AIR-COOLED CONDENSING UNITS

A. Verify proper rotation of fan(s).

B. Measure and record entering- and leaving-air temperatures.

C. Measure and record entering and leaving refrigerant pressures.

D. Measure and record operating data of compressor(s), fan(s), and motors.

3.13 PROCEDURES FOR AIR-COOLED CONDENSERS

A. Verify proper rotation of fan(s).

B. Measure and record entering- and leaving-air temperatures.

C. Measure and record entering and leaving refrigerant pressures.

D. Measure and record operating data of fan(s) and motor(s).

3.14 PROCEDURES FOR EXHAUST HOODS

A. Room Pressure: Measure and record room pressure with respect to atmosphere and adjacent space with hoods in room initially not operating and then with hoods operating.

B. Makeup Air: Systems supplying source of makeup air to hoods shall be in operation during testing and balancing of exhaust hoods.

1. Measure and record temperature of makeup air entering hood. If hood makeup air is from multiple sources having different temperatures, measure and record the airflow and temperatures of each source and calculate the weighted average temperature.
2. Use simulated smoke to observe supply air-distribution air patterns in vicinity of hoods. Consult with hood manufacturer and report conditions that have a detrimental effect on intended capture, containment, and other attributes effecting proper operation.

C. Rooms with Multiple Hoods: Test each hood separately, one at a time, and repeat tests with all hoods intended to operate simultaneously by design.

D. Canopy Hoods: Measure and record the following:

1. Pressure drop across hood.
2. Airflow by duct traverse where duct distribution will allow accurate measurement, and calculate hood average face velocity.
3. Measure velocity across hood face and calculate hood airflow.

    a. Clearly indicate the direction of flow at each point of measurement.
    b. Measure velocity across opening on not less than 12-inch centers. Record velocity at each measurement, and calculate average velocity.

4. Capture and Containment: Check each hood for proper capture and containment using a smoke-emitting device. Observe and report performance. Make adjustments to achieve optimum results.

E. Kitchen Hoods:

1. Type 1: Measure and record pressure drop and face velocity of hood filters and slots in accordance with hood manufacturer's instructions. Consult hood manufacturer to determine hood airflow using recorded information.
2. Type 2: Measure and record airflow by duct traverse.

F. AHJ Tests: Conduct additional tests required by authorities having jurisdiction.

3.15 SOUND TESTS

A. After systems are balanced and Substantial Completion, measure and record sound levels at five [10] locations as designated by the Architect.

B. Instrumentation:

1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (L_{eq}).
3. The sound-testing meter must be capable of using one-third octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
4. The accuracy of the sound-testing meter shall be plus or minus one decibel.

C. Test Procedures:

1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
2. Equipment should be operating at design values.
3. Calibrate the sound-testing meter prior to taking measurements.
4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.
5. Record a set of background measurements in dBA and sound pressure levels in the eight unweighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
6. Take sound readings in dBA and sound pressure levels in the eight unweighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
7. Take readings no closer than 36 inches from a wall or from the operating equipment and approximately 60 inches from the floor, with the meter held or mounted on a tripod.
8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:

a. Location.
b. System tested.
c. dBA reading.
d. Sound pressure level in each octave band with equipment on and off.

2. Plot sound pressure levels on Noise Criteria (NC) worksheet with equipment on and off.

3.16 VIBRATION TESTS

A. After systems are balanced and Substantially Completion, measure and record vibration levels on equipment having motor horsepower equal to or greater than 10 hp.

B. Instrumentation:

1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
4. Verify calibration date is current for vibration meter before taking readings.

C. Test Procedures:

1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.
2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
4. Record CPM or rpm.
5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

D. Reporting:

1. Report shall record location and the system tested.
2. Include horizontal-vertical-axial measurements for tests.
3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from AABC's "National Standards for Total System Balance." Acceptable levels of vibration are normally "smooth" to "good."
4. Include in General Machinery Vibration Severity Chart, with conditions plotted.

3.17 DUCT LEAKAGE TESTS

A. Witness the duct leakage testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified limits.

C. Report deficiencies observed.

3.18 PIPE LEAKAGE TESTS

A. Witness the pipe pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified limits.

C. Report deficiencies observed.

3.19 HVAC CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify HVAC control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.
6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.20 PROCEDURES FOR STAIR-PRESSURIZATION SYSTEMS

A. Before testing, observe each pressurized stair enclosure to verify construction is complete. Verify the following:

1. Walls and ceiling are free of unintended openings and are capable of achieving a pressure boundary.
2. Firestopping and sealants are installed.
3. Doors, door closers, and door gaskets are installed and adjusted.
4. If applicable, window installation is complete.
5. Stair-pressurization fans and associated controls are installed and functioning properly.
6. Stair-pressurization duct distribution and air outlets are installed.
7. Life-safety dampers (smoke or combination fire and smoke) are installed and functioning properly.

B. Measure and record barometric pressure, wind speed and direction, outdoor-air temperature, and relative humidity on each test day.

C. Test each stair enclosure as a single system. If multiple fans serve a single stair enclosure, operate fans as intended by the design.

D. Initial Air Balance:

1. Open doors to floors where indicated by design and measure, adjust, and record the airflow of each:

a. Stair-pressurization fan. For ducted systems, measure fan airflow by duct Pitot-tube traverse unless duct distribution does not permit accurate readings.
b. Air outlet supplying stair enclosure.
c. Adjust enclosure total airflow to achieve design pressurization.
d. Adjust method of stair enclosure pressure relief to prevent overpressurization.

E. Pressurization Test and Adjustments:

1. After air balancing is complete, perform stair enclosure pressurization tests.
2. Establish a consistent procedure for recording data throughout entire test.
3. Use stair side of doors as pressure reference point.

    a. Positive Pressure: Floor side of door higher than stair side.
    b. Negative Pressure: Floor side of door lower than stair side.

4. With HVAC systems and stair-pressurization systems off, measure and record the following:

    a. Pressure difference across each stair enclosure door, with all doors in the stair enclosure closed.
    b. Force necessary to open each door, using a spring-type scale.
    c. Adjustment needed to achieve design pressurization of enclosure total airflow.
    d. Adjustment needed to method of stair enclosure pressure relief, to prevent overpressurization.

5. With HVAC systems operating in normal mode and stair-pressurization systems off, measure and record the following:

    a. Pressure difference across each stair enclosure door, with all doors in the stair enclosure closed.
    b. Force necessary to open each door, using a spring-type scale.
    c. Adjustment needed to achieve design pressurization of enclosure total airflow.
    d. Adjustment needed to method of stair enclosure pressure relief, to prevent overpressurization.

6. With HVAC systems and stair-pressurization system operating simultaneously, perform the following:

    a. Place HVAC systems in normal operating mode, including equipment not used to implement smoke control, such as air-handling units, exhaust fans, and similar equipment.
    b. Measure and record pressure difference across each stair enclosure door, with all doors in stair enclosure closed.
    c. Use a spring scale to measure and record the force needed to open all stair enclosure doors.
    d. Adjust enclosure total airflow to achieve design pressurization.
    e. Adjust method of stair enclosure pressure relief to prevent overpressurization.
    f. Additional Tests for Designs with Open Doors:

        1) With exit door to outdoors in open position, measure and record pressure difference across each of the remaining closed stair enclosure doors.
        2) Open additional doors (up to the number indicated by design) one at a time, and measure and record pressure difference across each remaining closed stair enclosure door after the opening of each additional door.
        3) For each different test condition, measure and record the direction and velocity through each of the open doors by a traverse of every 1 sq. ft. grid of door opening.

4) For each different test condition, calculate average of door velocity measurements. Compare average velocity to design and governing code requirements.
5) Adjust enclosure total airflow to achieve design pressurization.
6) Adjust method of stair enclosure pressure relief to prevent overpressurization.

7. Repeat pressurization tests with the smoke-control systems and HVAC systems operating.
8. Criteria for Acceptance:

a. Compliance with design requirements.
b. Compliance with code requirements.
c. Compliance with additional requirements required by authorities having jurisdiction.

F. Operational Tests:

1. Check proper activation of stair-pressurization system(s) in response to all means of activation, both automatic and manual.
2. Verify that each initiating occurrence produces the proper system response under each of the following modes of operation:

a. Normal.
b. Alarm.
c. Manual override.
d. Return to normal.

3. Verify smoke detector at pressurization fan de-energizes fan and closes isolation damper when smoke detector is activated and in alarm.
4. If standby power is provided for pressurization systems, test to verify pressurization systems operate while on both normal and standby power.
5. Check operation in accordance with design indicated.

G. AHJ Tests: Conduct additional tests required by authorities having jurisdiction.

H. Report: Prepare and submit a complete report of observations, measurements, and deficiencies. Include names and contact information of individuals conducting tests and of individuals witnessing tests.

3.21 PROCEDURES FOR SMOKE-CONTROL SYSTEM TESTING

A. Before testing smoke-control systems, review design documents to understand operating requirements and design intent:

1. Review boundaries of each smoke zone.
2. Review location, size, and operating characteristics of equipment, such as smoke and fire smoke dampers.
3. Review sequence of operation, operating status of equipment, and positon of smoke and fire dampers for each smoke zone alarm condition.

4. Review location and type of alarm detection used to initiate smoke control for each smoke zone.
5. Review other smoke-control system attributes not listed but required for code compliance and acceptance by authorities having jurisdiction.

B. Before testing smoke-control systems, verify that construction is complete and verify the integrity of each smoke-control zone boundary.

1. Verify that windows, doors, walls, ceilings, and floors (six-sided boundary) are closed and that applicable safing, gasket, and firestops and sealants are installed.
2. Report deficiencies and postpone testing until after the reported deficiencies are corrected.

C. Measure and record barometric pressure, wind speed and direction, outdoor-air temperature, and relative humidity on each test day.

D. Measure, adjust, and record airflow of each smoke-control system, with all fans that are a part of system operating as intended by the design.

1. Measure, adjust, and record the airflow of each fan. For ducted systems, measure fan airflow by duct Pitot-tube traverse.
2. Measure, adjust, and record the airflow of each exhaust inlet and supply outlet.
3. Measure, adjust, and record airflow in main and branch ducts.

E. Smoke Control by Pressurization: After air balancing is complete, perform the following pressurization testing for each smoke-control zone in the system designed for isolation by using pressurization boundaries:

1. Verify the boundaries of each smoke-control zone.
2. With the HVAC systems in their normal mode of operation and smoke control not operating, measure and record the pressure difference across each smoke-control zone. Make measurements after closing doors that separate the zones. Make one measurement across each door. Clearly indicate the high- and low-pressure side of each door.
3. With the system operating in the smoke-control mode and with each separate zone in the smoke-control system activated, perform the following:

a. Measure and record the pressure difference across each door that separates the smoke zone from adjacent zones.

1) Make measurements with doors that separate the smoke zone from the other zones closed.
2) Clearly indicate the high- and low-pressure side of the door.
3) Doors that have a tendency to open slightly due to the pressure difference should have one pressure measurement made while held closed and another measurement made with the door open.

b. Continue to activate each separate smoke zone within each smoke-control system, and make pressure-difference measurements.
c. After testing a smoke zone's smoke-control system, deactivate the HVAC systems involved and return them to their normal operating mode before activating another zone's smoke-control system.

d. Verify that controls necessary to prevent excessive pressure differences are functional and operating within design set points and limits.

F. Smoke-Control Systems for Atriums and Other Large-Volume Spaces: After air balancing is complete, perform the following testing for each smoke-control system serving atriums and other large-volume spaces:

1. Verify and document the boundaries served by each smoke-control system.
2. Identify and document closed doors, open doors, and other boundary openings to be left open to adjacent areas and that are to be protected by airflow alone.
3. With the HVAC systems in their normal mode of operation and smoke-control systems not operating, measure and record the following:

   a. Pressure difference across each door that separates the smoke-zone from adjacent zones.
   b. Velocity for each point in traverse across each boundary opening:

      1) Clearly indicate the direction of flow.
      2) Measure velocity across opening on 12-inch centers using a vane anemometer.
      3) Calculate and report airflow.

4. With system operating in the smoke-control mode, measure and record the following:

   a. Pressure difference across each door that separates the smoke-zone from adjacent zones.
   b. Velocity for each point in traverse across each opening:

      1) Clearly indicate the direction of flow.
      2) Measure velocity across opening on 12-inch centers using a vane anemometer.
      3) Calculate and report airflow.

5. Verify system operation and make adjustments to achieve design pressure differences and air velocities within design set points and upper operating limits.

G. Operational Tests:

1. Check the proper activation of each zone of each smoke-control system in response to all means of activation, both automatic and manual.
2. Check automatic activation in response to fire alarm signals received from the building's fire alarm system. Initiate a separate alarm for each means of activation to ensure that the proper operation of the correct zone of each smoke-control system occurs.
3. Check and record proper operation of fans, dampers, and related equipment for each separate zone of each smoke-control system:

   a. Zone in which a smoke-control system automatically activates.
   b. Type of signal that activates smoke-control system, such as sprinkler flow or smoke detector.
   c. Smoke zone(s) where maximum mechanical exhaust to the outside is implemented and no supply air is provided.

d. Positive-pressure smoke-control zone(s) where maximum air supply is implemented and no exhaust to the outside is provided.
e. Fan(s) "ON" as required to implement the smoke-control system. Multiple- or variable-speed fans should be further noted to verify that the intended control configuration is achieved.
f. Fan(s) "OFF" as required to implement the smoke-control system.
g. Damper(s) "OPEN" or at an adjustable positon where maximum airflow must be achieved.
h. Damper(s) "CLOSED" where no airflow should take place.
i. Auxiliary functions to achieve the smoke-control system configuration, such as changes or override of normal operating pressure and temperature-control set points.
j. If standby power is provided for the smoke-control system, test to verify that the system functions while operating under both normal and standby power.
k. Check operation in accordance with design indicated.

H. AHJ Tests: Conduct additional tests required by authorities having jurisdiction. Unless required by authorities having jurisdiction, perform testing without the use of smoke or products that simulate smoke.

I. Report: Prepare and submit a complete report of observations, measurements, and deficiencies. Include names and contact information of individuals conducting tests and of individuals witnessing tests.

3.22 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan and equipment with fan(s).
2. Measure and record flows, temperatures, and pressures of each piece of equipment in each hydronic system. Compare the values to design or nameplate information, where information is available.
3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
4. Check the refrigerant charge.
5. Check the condition of filters.
6. Check the condition of coils.
7. Check the operation of the drain pan and condensate-drain trap.
8. Check bearings and other lubricated parts for proper lubrication.
9. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. TAB After Construction: Before performing testing and balancing of renovated existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished in accordance with renovation scope indicated by Contract Documents. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.

3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 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.

3.23 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. If design value is less than 100 cfm, within 10 cfm.
2. Air Outlets and Inlets: Plus or minus 10 percent. If design value is less than 100 cfm, within 10 cfm.
3. Heating-Water Flow Rate: Plus or minus 5 percent. If design value is less than 10 gpm, within 10 percent.
4. Chilled-Water Flow Rate: Plus or minus 5 percent. If design value is less than 10 gpm, within 10 percent.
5. Condenser-Water Flow Rate: Plus or minus 5 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.24 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.25 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 performance forms, including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Heating coil, dry-bulb conditions.
    e. Face and bypass damper settings at coils.
    f. Fan drive settings, including settings and percentage of maximum pitch diameter.
    g. Inlet vane settings for variable-air-volume systems.

h. Settings for pressure controller(s).
i. Other system operating conditions that affect performance.

16. Test conditions for pump performance forms, including the following:

a. Variable-frequency controller settings for variable-flow hydronic systems.
b. Settings for pressure controller(s).
c. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Unit arrangement and class.
g. Discharge arrangement.
h. Sheave make, size in inches, and bore.
i. Center-to-center dimensions of sheave and amount of adjustments in inches.
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed.
d. Inlet and discharge static pressure in inches wg.

e. For each filter bank, filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. List for each internal component with pressure-drop, static-pressure differential in inches wg.
j. Outdoor airflow in cfm.
k. Return airflow in cfm.
l. Outdoor-air damper position.
m. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Refrigerant expansion valve and refrigerant types.
i. Refrigerant suction pressure in psig.
j. Refrigerant suction temperature in deg F.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.

h. Ignition type.
i. Burner-control types.
j. Motor horsepower and speed.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System fan and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Apparatus used for test.
d. Area served.
e. Make.
f. Number from system diagram.
g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.26 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.

B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.27 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 232300 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Steel pipe and fittings.
3. Valves and specialties.
4. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve, refrigerant piping, and piping specialty.

1. Include pressure drop, based on manufacturer's test data, for the following:

a. Thermostatic expansion valves.
b. Solenoid valves.
c. Hot-gas bypass valves.
d. Filter dryers.
e. Strainers.
f. Pressure-regulating valves.

B. Shop Drawings:

1. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
2. Show interface and spatial relationships between piping and equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. 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 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-134a:

1. Suction Lines for Air-Conditioning Applications: 115 psig.
2. Suction Lines for Heat-Pump Applications: 225 psig.
3. Hot-Gas and Liquid Lines: 225 psig.

B. Line Test Pressure for Refrigerant R-407C:

1. Suction Lines for Air-Conditioning Applications: 230 psig.
2. Suction Lines for Heat-Pump Applications: 380 psig.
3. Hot-Gas and Liquid Lines: 380 psig.

C. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 280, Type ACR.

B. Wrought-Copper Fittings, Solder-Joint: ASME B16.22.

C. Wrought-Copper Fittings, Brazed-Joint: ASME B16.50.

D. Wrought-Copper Unions: ASME B16.22.

E. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

F. Brazing Filler Metals: AWS A5.8/A5.8M.

G. 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.

H. Copper-Tube, Pressure-Seal-Joint Fittings for Refrigerant Piping:

1. Standard: UL 207; certified by UL for field installation. Certification as a UL-recognized component alone is unacceptable.
2. Housing: Copper.
3. O-Rings: HNBR or compatible with specific refrigerant.
4. Tools: Manufacturer's approved special tools.
5. Minimum Rated Pressure: 700 psig.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as selected in piping application articles.

B. Wrought-Steel Fittings: ASTM A 234/A 234M, for welded joints.

C. Steel Flanges and Flanged Fittings: ASME B16.5, steel, including bolts, nuts, and gaskets, bevel-welded end connection, and raised face.

D. 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.

E. Flanged Unions:

1. Body: Forged-steel flanges for NPS 1 to NPS 1-1/2 and ductile iron for NPS 2 to NPS 3. Apply rust-resistant finish at factory.
2. Gasket: Fiber asbestos free.
3. Fasteners: Four plated-steel bolts, with silicon bronze nuts. Apply rust-resistant finish at factory.
4. End Connections: Brass tailpiece adapters for solder-end connections to copper tubing.
5. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch- long assembly.
6. Pressure Rating: Factory test at minimum 400 psig.
7. Maximum Operating Temperature: 330 deg F.

F. Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, stainless-steel-wire-reinforced protective jacket.

2. End Connections:

   a. NPS 2 and Smaller: With threaded-end connections.
   b. NPS 2-1/2 and Larger: With flanged-end connections.

3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Pressure Rating: Factory test at minimum 500 psig.
5. Maximum Operating Temperature: 250 deg F.

2.4 VALVES AND SPECIALTIES

A. Diaphragm Packless Valves:
   1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
   2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
   3. Operator: Rising stem and hand wheel.
   4. Seat: Nylon.
   5. End Connections: Socket, union, or flanged.
   6. Working Pressure Rating: 500 psig.
   7. Maximum Operating Temperature: 275 deg F.

B. Packed-Angle Valves:
   1. Body and Bonnet: Forged brass or cast bronze.
   2. Packing: Molded stem, back seating, and replaceable under pressure.
   3. Operator: Rising stem.
   4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
   5. Seal Cap: Forged-brass or valox hex cap.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Working Pressure Rating: 500 psig.
   8. Maximum Operating Temperature: 275 deg F.

C. Check Valves:
   1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
   2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
   3. Piston: Removable polytetrafluoroethylene seat.
   4. Closing Spring: Stainless steel.
   5. Manual Opening Stem: Seal cap, plated-steel stem, and graphite seal.
   6. End Connections: Socket, union, threaded, or flanged.
   7. Maximum Opening Pressure: 0.50 psig.
   8. Working Pressure Rating: 500 psig.
   9. Maximum Operating Temperature: 275 deg F.

D. Service Valves:
   1. Body: Forged brass with brass cap including key end to remove core.
   2. Core: Removable ball-type check valve with stainless-steel spring.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Copper spring.
   5. Working Pressure Rating: 500 psig.

E. Refrigerant Locking Caps:
   1. Description: Locking-type, tamper-resistant, threaded caps to protect refrigerant charging ports from unauthorized refrigerant access and leakage.
   2. Material: Brass, with protective shroud or sleeve.
   3. Refrigerant Identification: Universal design.
   4. Special Tool: For installing and unlocking.

F. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
   1. Body and Bonnet: Plated steel.
   2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and 24-V ac coil.
   6. Working Pressure Rating: 400 psig.
   7. Maximum Operating Temperature: 240 deg F.

G. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
   1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
   2. Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Seat: Polytetrafluoroethylene.
   4. End Connections: Threaded.
   5. Working Pressure Rating: 400 psig.
   6. Maximum Operating Temperature: 240 deg F.

H. Thermostatic Expansion Valves: Comply with AHRI 750.
   1. Body, Bonnet, and Seal Cap: Forged brass or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
   5. Suction Temperature: 40 deg F.
   6. Superheat: Adjustable.
   7. Reverse-flow option (for heat-pump applications).
   8. End Connections: Socket, flare, or threaded union.
   9. Working Pressure Rating: 700 psig.

I. Hot-Gas Bypass Valves: Comply with UL 429; listed and labeled by an NRTL.
   1. Body, Bonnet, and Seal Cap: Ductile iron or steel.
   2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
   3. Packing and Gaskets: Non-asbestos.
   4. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
   5. Seat: Polytetrafluoroethylene.
   6. Equalizer: Internal.
   7. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter and 24-V ac coil.
   8. End Connections: Socket.
   9. Throttling Range: Maximum 5 psig.
   10. Working Pressure Rating: 500 psig.
   11. Maximum Operating Temperature: 240 deg F.

J. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
2. Screen: 100-mesh stainless steel.
3. End Connections: Socket or flare.
4. Working Pressure Rating: 500 psig.
5. Maximum Operating Temperature: 275 deg F.

K. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
2. Drain Plug: Brass hex plug.
3. Screen: 100-mesh monel.
4. End Connections: Socket or flare.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 275 deg F.

L. Moisture/Liquid Indicators:
1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in parts per million (ppm).
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

M. Replaceable-Core Filter Dryers: Comply with AHRI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.

N. Permanent Filter Dryers: Comply with AHRI 730.
1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina.
4. Maximum Pressure Loss: 2 psig.
5. Working Pressure Rating: 500 psig.
6. Maximum Operating Temperature: 240 deg F.

O. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or flare.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

P. Receivers: Comply with AHRI 495.
1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
2. Comply with UL 207; listed and labeled by an NRTL.
3. Body: Welded steel with corrosion-resistant coating.
4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.

5. End Connections: Socket or threaded.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

Q. Liquid Accumulators: Comply with AHRI 495.
1. Body: Welded steel with corrosion-resistant coating.
2. End Connections: Socket or threaded.
3. Working Pressure Rating: 500 psig.
4. Maximum Operating Temperature: 275 deg F.

2.5 REFRIGERANTS

A. ASHRAE 34, R-134a: Tetrafluoroethane.

B. ASHRAE 34, R-407C: Difluoromethane/Pentafluoroethane/1,1,1,2-Tetrafluoroethane.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-134a

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines:

1. Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Safety-Relief-Valve Discharge Piping, Copper: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

D. Safety-Relief-Valve Discharge Piping, Multiple Tube Types and Joining Methods:

1. NPS 1-1/2 and Smaller, Type ACR, Annealed Temper: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 4: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 PIPING APPLICATIONS FOR REFRIGERANT R-407C

A. Suction Lines NPS 1-1/2 for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines:

1. Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Safety-Relief-Valve Discharge Piping, Copper: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

D. Safety-Relief-Valve Discharge Piping, Multiple Tube Types and Joining Materials:

1. NPS 1 and Smaller, Type ACR, Annealed Temper: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.
2. NPS 1-1/4 to NPS 2: Copper, Type K, annealed- or drawn-temper tubing and wrought-copper fittings with [brazed] [or] [soldered] joints.
3. NPS 4: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with soldered joints.

3.3 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Suction Lines NPS 2 to NPS 3-1/2 for Conventional Air-Conditioning Applications: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines:

1. Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Safety-Relief-Valve Discharge Piping:

1. Copper, Type ACR, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.4 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gauge taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at top.

F. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

G. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

I. Install strainers upstream from and adjacent to the following unless they are furnished as an integral assembly for the device being protected:

1. Solenoid valves.
2. Thermostatic expansion valves.
3. Hot-gas bypass valves.
4. Compressor.

J. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

K. Install receivers sized to accommodate pump-down charge.

L. Install flexible connectors at compressors.

M. Provide refrigerant locking caps on refrigerant charging ports that are located outdoors unless otherwise protected from unauthorized access by a means acceptable to the authority having jurisdiction.

3.5 INSTALLATION OF PIPING, GENERAL

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. 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.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

R. Identify refrigerant piping and valves.

S. Install sleeves for piping penetrations of walls, ceilings, and floors.

T. Install sleeve seals for piping penetrations of concrete walls and slabs.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.6 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

F. Threaded Joints: Thread steel 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 to restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

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 and steel 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.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of copper tubing and steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.8 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.

3.9 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.10 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves except bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Duct liner.
7. Sealants and gaskets.
8. Hangers and supports.
9. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top and bottom of ducts.
5. Dimensions of [all] duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Welding certificates.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
3. Where specified for specific applications, all joints shall be welded.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.

1. Where specified for specific applications, all joints shall be welded.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.

2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
3. Where specified for specific applications, all joints shall be welded.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.

1. Where specified for specific applications, all joints shall be welded.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
2. Coat insulation with antimicrobial coating.
3. Cover insulation with polyester film complying with UL 181, Class 1.

F. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

2.4 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

1. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

    a. Construct ducts of galvanized sheet steel unless otherwise indicated.
    b. For ducts exposed to weather, construct outer duct of Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.

2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
    b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch diameter perforations, with overall open area of 23 percent.

C. Interstitial Insulation: Fibrous-glass liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
   1. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
   2. Coat insulation with antimicrobial coating.
   3. Cover insulation with polyester film complying with UL 181, Class 1.

2.6 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653/A653M.

   1. Galvanized Coating Designation: G60.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. PVC-Coated, Galvanized Sheet Steel: Comply with ASTM A653/A653M.

   1. Galvanized Coating Designation: G60.
   2. Minimum Thickness for Factory-Applied PVC Coating: 4 mils thick.
   3. Coating Materials: Acceptable to authorities having jurisdiction for use on ducts listed and labeled by an NRTL for compliance with UL 181, Class 1.

D. Carbon-Steel Sheets: Comply with ASTM A1008/A1008M, with oiled, matte finish for exposed ducts.

E. Stainless-Steel Sheets: Comply with ASTM A480/A480M, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

F. Aluminum Sheets: Comply with ASTM B209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

G. Factory- or Shop-Applied Antimicrobial Coating:

   1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
   2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
   3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested in accordance with ASTM D3363.
   4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

5. Shop-Applied Coating Color: Black.
6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

H. Reinforcement Shapes and Plates: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

I. 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.

2.7 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Solvent-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
2. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

C. Fiberglass-Free Duct Liner: Made from partially recycled cotton or polyester products and containing no fiberglass. Airstream surface overlaid with fire-resistant facing to prevent surface erosion by airstream, complying with NFPA 90A or NFPA 90B. Treat natural-fiber products with antimicrobial coating.
1. Maximum Thermal Conductivity: 0.24 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature when tested in accordance with ASTM C518.
2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with ASTM E84; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

D. Insulation Pins and Washers:

1. Cupped-Head, 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 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.

E. 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. 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.
7. 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.

8. 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.

2.8 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated 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.

2.9 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A492.

F. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation

M. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR TYPE 1 COMMERCIAL KITCHEN GREASE HOOD EXHAUST DUCT

A. Install ducts in accordance with NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operation"; SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; and SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines" unless otherwise indicated.

B. Install all ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

C. All ducts exposed to view shall be constructed of stainless steel as per "Duct Schedule" Article. All ducts concealed from view shall be stainless steel as per "Duct Schedule" Article.

D. All joints shall be welded and shall be telescoping, bell, or flange joint as per NFPA 96.

E. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.

F. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 ADDITIONAL INSTALLATION REQUIREMENTS FOR EXHAUST DUCTS SERVING COMMERCIAL DISHWASHERS AND OTHER HIGH-HUMIDITY LOCATIONS

A. Install dishwasher exhaust ducts and other exhaust ducts from wet, high-humidity locations without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to dishwasher or toward drain.

B. Provide a drain pocket at each low point and at the base of each riser with a 1-inch trapped copper drain from each drain pocket to open site floor drain.

C. Minimize number of transverse seams.

D. Do not locate longitudinal seams on bottom of duct.

3.5 ADDITIONAL INSTALLATION REQUIREMENTS FOR LABORATORY EXHAUST AND FUME HOOD EXHAUST DUCTS

A. Install ducts in accordance with NFPA 45, "Fire Protection for Laboratories Using Chemicals."

B. Install exhaust ducts without dips and traps that may hold water. Slope ducts a minimum of 2 percent back to hood or inlet. Where indicated on Drawings, install trapped drain piping.

C. Connect duct to fan, fume hood, and other equipment indicated on Drawings.

3.6 DUCTWORK EXPOSED TO WEATHER

A. All external joints are to be welded. Seal all openings to provide weatherproof construction.

B. Construct ductwork to resist external loads of wind, snow, ice, and other effects of weather. Provide necessary supporting structures.

C. Single Wall:

1. Ductwork shall be Type 304 stainless steel.
2. Ductwork shall be galvanized steel.

    a. If duct outer surface is uninsulated, protect outer surface with suitable paint.

3. Where ducts have external insulation, provide weatherproof aluminum jacket.

D. Double Wall:

1. Ductwork shall comply with requirements in "Double-Wall Rectangular Ducts and Fittings" or "Double-Wall Round Ducts and Fittings" Article.
2. Ductwork outer wall shall be Type 304 stainless steel indicated by manufacturer to be suitable for outdoor installation.
3. Provide interstitial insulation.

3.7 DUCT SEALING

A. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.9 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.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.

2. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
3. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. For cleaning of existing ductwork, see Section 230130.52 "Existing HVAC Air Distribution System Cleaning."

C. Use duct cleaning methodology as indicated in NADCA ACR.

D. Use service openings for entry and inspection.

1. Provide openings with access panels appropriate for duct static-pressure and leakage class at dampers, coils, and any other locations where required for inspection and cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

E. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

F. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

G. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans in accordance with NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents in accordance with manufacturer's written instructions after removal of surface deposits and debris.

3.12 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 233113

SECTION 233346 - FLEXIBLE DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-insulated flexible ducts.
2. Insulated flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For flexible ducts.

1. Include plans showing locations and mounting and attachment details.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."

D. Comply with ASTM E96/E96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 NON-INSULATED FLEXIBLE DUCTS

A. Non-Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

2.3 INSULATED FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-Value: Comply with ASHRAE/IES 90.1.

2.4 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Liquid adhesive plus tape.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

D. Connect diffusers or light troffer boots to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

E. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

F. Install duct test holes where required for testing and balancing purposes.

G. Installation:

1. Install ducts fully extended.
2. Do not bend ducts across sharp corners.
3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
5. Install flexible ducts in a direct line, without sags, twists, or turns.

H. Supporting Flexible Ducts:

1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
2. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.
4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.

END OF SECTION 233346

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Tray cable, Type TC.
2. Metal-clad cable, Type MC
3. Connectors and splices.

B. Related Requirements:

PART 2 - PRODUCTS

2.1 TRAY CABLE, TYPE TC

A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in a nonmetallic jacket.

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 1277.
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. Ground Conductor: Insulated.

E. Conductor Insulation: Type THHN.

F. Shield: None

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. 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.
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.

E. Ground Conductor: Insulated.

F. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.

G. Armor: Aluminum, interlocked.

2.3 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. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper
2. Type: One hole with standard barrels.
3. Termination: Screw.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.2 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.

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Category 6 balanced twisted pair cable.
   2. Control-circuit conductors.

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.

2.2 CATEGORY 6 BALANCED TWISTED PAIR CABLE

A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250 MHz.

B. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.

C. Conductors: 100 ohm, No. 23 AWG solid copper.

D. Shielding/Screening: Unshielded twisted pairs (UTP)

E. Cable Rating: Riser.

F. Jacket: Blue thermoplastic.

2.3 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.

1. Smoke control signaling and control circuits.

2.4 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, No. 16 AWG or 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. Control-Voltage Circuits: No. 16 AWG, minimum, in pathway.
2. Low-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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Test cables on receipt at Project site.

1. Test each pair of twisted pair cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

1. Outlet boxes must be no smaller than 2 inch wide, 3 inch high, and 2-1/2 inch deep.
2. Flexible metal conduit must not be used.

B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway Installation in Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard if entering the room from overhead.
4. Extend conduits 3 inches above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps in closer proximity for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:

1. Comply with TIA-568-C.2.

2. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
3. Cable must not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inch of cable in a coil not less than 12 inches in diameter.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications 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 must be as follows:

a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.

3.4 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.5 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits; No 14 AWG
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG

3.6 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.7 GROUNDING

A. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

A. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.

B. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm 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.

END OF SECTION 260523

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

1.3 QUALITY ASSURANCE

A. 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: Selected for applicable load criteria
4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

B. Aluminum Slotted Support Systems: Extruded-aluminum 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. Channel Material: 6063-T5 aluminum alloy.
3. Fittings and Accessories Material: 5052-H32 aluminum alloy.
4. Channel Width: Selected for applicable load criteria

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
2. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325
3. Toggle Bolts: All-steel springhead type.
4. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except when specified otherwise in this article.

B. Raceway Support Methods: In addition to methods described in NECA 1, IMC and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69
6. To Light Steel: Sheet metal screws.
7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Type EMT-S raceways and elbows.
2. Type LFMC raceways.
3. Type PVC raceways and fittings.
4. Fittings for conduit, tubing, and cable.
5. Strut-type channel raceways and fittings.
6. Wireways and auxiliary gutters.
7. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.

B. Related Requirements:
1. Section 260519 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).
2. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Steel Electrical Metal Tubing (EMT-S) and Elbows:

1. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL 797 and UL Category Control Number FJMX.
2) Material: Steel.
3) Exterior Coating: Zinc.
4) Interior Coating: Zinc.

c. Options:

1) Minimum Trade Size: 1/2 inch (16 mm).
2) Colors: As indicated on Drawings.

2.2 TYPE LFMC RACEWAYS

A. Steel Liquidtight Flexible Metal Conduit (LFMC-S):

1. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standard: UL 360 and UL Category Control Number DXHR.
2) Material: Steel.

c. Options:

1) Minimum Trade Size: 1/2 inch (16 mm).

2.3 TYPE PVC RACEWAYS AND FITTINGS

A. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
1. Applicable Standards:

a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:

1) Reference Standards: UL 651 and UL Category Control Number DZYR.
2) Dimensional Specifications: Schedule 40.

c. Options:

1) Minimum Trade Size: 3/4 inch.
2) Markings: For use with maximum 90 deg C wire.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Engineer for resolution of conflicting requirements.

B. Outdoors:

1. Exposed Conduit: LFMC
2. Concealed Conduit, Aboveground: EMT-S
3. Direct-Buried Conduit: PVC-80
4. Concrete-Encased Conduit in Trench: PVC-40

3.2 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Engineer for resolution of conflicting requirements.
2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Install raceways square to the enclosure and terminate at enclosures without hubs and with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
4. 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.
5. Raceway Terminations at Locations Subject to Moisture or Vibration:

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft. above finished floor.
3. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inch of enclosures to which attached.
7. Cut conduit perpendicular to the length. For conduits 2 inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
8. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

9. Types PVC and EPEC:

    a. Do not install Type PVC or Type EPEC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
    b. Comply with manufacturer's written instructions for solvent welding and fittings.

C. Raceways Embedded in Slabs:
1. Arrange raceways to ensure that each is surrounded by a minimum of 2 inches of concrete without voids.

2. Do not embed threadless fittings in concrete unless locations have been specifically approved by Engineer.

3.3 INSTALLATION OF BOXES AND ENCLOSURES

A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

E. Locate boxes so that cover or plate will not span different building finishes.

F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for mounting purpose.

H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

I. Set metal floor boxes level and flush with finished floor surface.

J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

3.4 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 260533

SECTION 260923 - LIGHTING CONTROL 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. Switchbox mounted occupancy sensor
2. Conductors and cables.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

1.3 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
a. Faulty operation of lighting control devices.

2. Warranty Period: Two year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
4. Switch Rating: Not less than 800-VA LED load at 120 V.
5. Provisions for manual on/off switch and dimmer included.

B. Wall-Switch Sensor:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
2. Sensing Technology: PIR.
3. Switch Type: SP.
4. Capable of controlling load in three-way application.
5. Voltage: 120 V.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Color: White
8. Faceplate: Color matched to switch.

2.2 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF SENSORS

A. Comply with NECA 1.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.3 INSTALLATION OF CONTACTORS

A. Comply with NECA 1.

3.4 INSTALLATION OF WIRING

A. Comply with NECA 1.

B. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.

C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's written instructions.

D. Size conductors in accordance with lighting control device manufacturer's written instructions unless otherwise indicated.

E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Lighting control devices will be considered defective if they do not pass tests and inspections.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Load centers.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 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.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards.

B. Handle and prepare panelboards for installation according to NECA 407.

1.9 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

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 AND LOAD CENTERS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

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

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Kitchen & Wash-Down Areas: NEMA 250, Type
d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4

2. Height: 84 inches maximum.
3. 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.
4. Finishes:

a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back Boxes: Same finish as panels and trim.

F. Incoming Mains:

1. Location: Top

2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated aluminum

a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

I. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

1. Percentage of Future Space Capacity: 20 percent.

K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

A. Panelboards: NEMA PB 1, distribution type.

B. Mains: Circuit breaker or Lugs only.

C. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers or Bolt-on circuit breakers.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

E. Contactors in Main Bus: NEMA ICS 2, Class A, **mechanically** held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Mains: Circuit breaker or lugs only.

C. Branch Overcurrent Protective Devices: Plug-in or Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 LOAD CENTERS

A. Load Centers: Comply with UL 67.

B. Mains: Circuit breaker or lugs only.

C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Concealed hinges secured with flush latch with tumbler lock; keyed alike.

E. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.5 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:

        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. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. MCCB Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.
    b. Breaker handle indicates tripped status.
    c. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    d. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    e. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.

2.6 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.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.

1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407.

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407.

D. Equipment Mounting:
1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

K. Install filler plates in unused spaces.

3.3 IDENTIFICATION

A. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification.

3.4 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Panelboards will be considered defective if they do not pass tests and inspections.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20 A.
2. GFCI receptacles, 125 V, 20 A.
3. Toggle switches, 120 V, 20 A.
4. Occupancy sensors.
5. Wall plates.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: Almond unless otherwise indicated or required by NFPA 70 or device listing.

F. Wall Plate Color: For plastic covers, match device color.

G. 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. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. 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.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 :
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 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Type: 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.

2.4 TOGGLE SWITCHES, 120 V, 15 A

A. Single-Pole Switches, 120 V, 15 A:
1. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120 V, 15 A:
1. Standards: Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120 V, 15 A:
1. Comply with UL 20 and FS W-S-896.

D. Four-Way Switches, 120 V, 15 A:
1. Standards: Comply with UL 20 and FS W-S-896.

2.5 TOGGLE SWITCHES, 120 V, 20 A

A. Single-Pole Switches, 120 V, 20 A:
1. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120 V, 20 A:
1. Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120 V, 20 A:
1. Comply with UL 20 and FS W-S-896.

D. Four-Way Switches, 120 V, 20 A:
1. Standards: Comply with UL 20 and FS W-S-896.

2.6 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

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. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

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 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. See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Wiring device will be considered defective if it does not pass tests and inspections.

END OF SECTION 262726

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Recessed, linear.
   2. Suspended, linear.
   3. Materials.
   4. Luminaire support.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:

1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products -OR-
2. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.7 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 41 to 104 deg F

1. Relative Humidity: Zero to 95 percent.

B. Altitude: Sea level to 1000 feet

2.2 LUMINAIRE REQUIREMENTS

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

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

2.3 RECESSED

A. Nominal Operating Voltage: 120 VAC, 240 VAC.

B. Lamp:

1. Minimum 1,500 lm.
2. Minimum allowable efficacy of 85 lm/W.
3. CRI of 65, minimum. CCT of 5000K.
4. Rated lamp life of 35,000 hours (or higher) to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61.

C. Housings:

1. Die Cast Aluminum housing and heat sink.
2. Clear finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.4 SUSPENDED

A. Nominal Operating Voltage: 120 VAC, 240 VAC.

B. Lamp:

1. Minimum 1500 lm.
2. Minimum allowable efficacy of 85 lm/W.
3. CRI of 65, minimum. CCT of 5000k.
4. Rated lamp life of 3500 hours (or higher) to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. User-Replaceable Lamps:

    a. Bulb shape complying with ANSI C78.79.
    b. Lamp base complying with ANSI C81.61.

C. Housings:

1. Die Cast Aluminum housing and heat sink.
2. Clear finish.
3. With integral mounting provisions.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.5 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.6 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.

2.7 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 AWG.

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 Engineer, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each housing.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaires:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaires:

1. Attach to structural members in walls; Attached using through bolts and backing plates on either side of wall
2. Do not attach luminaires directly to gypsum board.

G. Suspended Luminaires:

1. Ceiling Mount:
   a. Pendant mount with 5/32-inch diameter aircraft cable supports adjustable up to 4 feet in length.
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.

H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

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 265119

SECTION 265213 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting.
2. Exit signs.
3. Materials.
4. Luminaire support components.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

B. Product Schedule:

1. For emergency lighting units use same designations indicated on Drawings.
2. For exit signs use same designations indicated on Drawings.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.6 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. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every 20 emergency lighting units. Furnish at least one of each type.
3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laborator that is accredited under National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products and complying with applicable IES testing standards.

1.8 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.

2. Warranty Period for Self-Powered Exit Sign Batteries: Five years from date of Substantial Completion. Full warranty shall apply for first year and prorated warranty for the remaining four years.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

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

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for fluorescent luminaires.

F. Lamp Base: Comply with **ANSI C81.61**.

G. Bulb Shape: Complying with ANSI C79.1.

H. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.

1. Emergency Connection: Operate lamps continuously at an output of 1100 lumens (or as specified on the drawings) each upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value exceeding 95 deg F over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
    c. Humidity: More than 95 percent (condensing).
    d. Altitude: Exceeding 3300 feet.
4. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

5. Battery: Sealed, maintenance-free, nickel-cadmium or lead-acid type.
6. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Lighting Unit:
1. Emergency Lighting Unit: as indicated on Drawings.
2. Operating at nominal voltage of 120 Vac.
3. Wall mount with universal junction box adaptor.
4. UV stable thermoplastic housing.
5. Two LED lamp heads.
6. Internal emergency power unit.

2.3 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Operating at nominal voltage of 120 V ac
2. Lamps for AC Operation:
a. LEDs; 50,000 hours minimum rated lamp life.

3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Conduit: EMT conduit, minimum 1/2 inch (16 mm) in diameter.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

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. Support Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

D. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls
2. Do not attach luminaires directly to gypsum board.

E. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. 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.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

3.3 STARTUP SERVICE

A. Perform startup service:
1. Charge emergency power units and batteries minimum of 24 hours and conduct one-hour discharge test.

END OF SECTION 265213

SECTION 284621.13 - CONVENTIONAL FIRE-ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Air-sampling smoke detectors.

B. Related Requirements:

1. Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

A. IMC: Intermediate Metal Conduit.

B. FACP: Fire Alarm Control Panel.

C. NICET: National Institute for Certification in Engineering Technologies.

1.4 ACTION SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Engineer.
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.

B. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, and profiles and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

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 input/output matrix.
6. 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.
7. Include performance parameters and installation details for each detector.
8. Verify that each duct smoke detector is listed for the complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
9. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
10. 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.
    d. Show air-sampling detector pipe routing.

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 smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. Include the following submittals:

    a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

b. Provide the "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. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Provide the "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.

f. Manufacturer's required maintenance related to system warranty requirements.
g. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke and Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
8. Filters for Air-Sampling Detectors: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
9. Air-Sampling Fan: Quantity equal to one for every five detectors, but no fewer than one unit of each type.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

C. NFPA Certification: Obtain certification according to NFPA 72.

1.8 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.9 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. All components provided shall be listed for use with the selected system.

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.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices:

1. Manual stations.
2. Smoke detectors.
3. Duct smoke detectors
4. Carbon monoxide detectors.
5. Combustible gas detectors
6. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm zone at fire-alarm control unit.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Record events in the system memory.
5. Indicate device in alarm on the graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and systems:
   1. 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 primary power at fire-alarm control unit.
   4. Ground or a single break in internal circuits of fire-alarm control unit.
   5. Abnormal ac voltage at fire-alarm control unit.
   6. Break in standby battery circuitry.
   7. Failure of battery charging.
   8. Abnormal position of any switch at fire-alarm control unit.

E. System Trouble and Supervisory Signal Actions:

   1. Initiate notification appliances.
   2. Annunciate at fire-alarm control unit.
   3. After a time delay of 200 seconds transmit a trouble or supervisory signal to the remote alarm receiving station.
   4. Transmit system status to building management system.
   5. Display system status on graphic annunciator.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

   1. Modular, power-limited design with electronic modules, UL 864 listed.

      a. Include a real-time clock for time annotation of events.
      b. The FACP shall be listed for connection to a central-station signaling system service.

B. Alphanumeric Display and System Controls: Display alarm, supervisory, and component status messages and the programming and control menu.

   1. Annunciator and Display: Liquid-crystal type

C. Circuits:

   1. No Fewer Than Five Initiating-Device Circuits:

      a. Four circuits, NFPA 72, Class B.
      b. One circuit(s), NFPA 72, Class A.

   2. No Fewer Than Two Notification-Appliance Circuits: NFPA 72, Class B.
   3. Pathway Survivability: Level 1.

D. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, AND trouble signals shall be powered by the 24-V dc source.

1. Alarm current draw of the entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

E. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

F. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Single-action mechanism, pull-lever type.
2. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Operating at 24-V dc, nominal.
2. Detectors shall be four-wire type.
3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
4. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
5. Integral Visual-Indicating Light: LED type, indicating detector has operated.

B. Photoelectric Smoke Detectors: Comply with UL 268.

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Remote indication and test station. Operating key switch initiates an alarm test.
2. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
3. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

2.6 CARBON MONOXIDE DETECTORS

A. Description: Listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Detector shall provide a means to test by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Detector shall be listed to comply with UL 2075.
6. Detectors shall be located, mounted, and wired according to manufacturer's written instructions.
7. Test button simulates an alarm condition.

2.7 COMBUSTIBLE GAS DETECTORS

A. Description: Listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.
2. Detector shall provide alarm contacts and trouble contacts.
3. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
4. Detector shall be listed to comply with UL 2075.
5. Detectors shall be located, mounted, and wired according to manufacturer's written instructions.
6. Test button simulates an alarm condition.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Smooth ceiling spacing shall not exceed 30 feet.
3. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
4. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
5. Luminaires: Locate detectors not closer than 12 inches from any part of a luminaire and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place, except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.3 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches above the floor shall be installed in IMC.

3.4 IDENTIFICATION

A. 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. 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:

1. Visual Inspection: Conduct the visual inspection prior to testing.

a. Inspection shall be based on completed record Drawings and system documentation that is required by NFPA 72 in Chapter 10 "Fundamentals," Section 10.18.21 "Completion Documents, Preparation."
b. Comply with NFPA 72, Chapter 14, "Inspection, Testing, and Maintenance," Section 14.3, "Inspection" and the "Visual Inspection Frequencies" Table; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with NFPA 72, Chapter 14, "Inspection, Testing, and Maintenance," Section 14.4 "Testing" and the "Test Methods" Table.
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 visible appliances for the public operating mode according to manufacturer's written instructions.
5. 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. Fire-alarm system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

F. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with the visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests listed in the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

END OF SECTION 284621.13

SECTION 32 1216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 GENERAL

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

B. All Contractors, Subcontractors, Vendors and the like shall be required to familiarize themselves with said provisions.

1.2 SECTION INCLUDES

A. Asphaltic binder course and bituminous wearing course materials.

B. Placing and compacting asphaltic binder course and asphaltic wearing course.

C. Striping.

1.3 RELATED DRAWINGS, DOCUMENTS, AND SECTIONS

A. Civil Drawing Package prepared by Civil & Environmental Consultants, Inc., and all updates.

B. Geotechnical Report, and all updates.

C. Erosion and Sediment Control Plan prepared by Civil & Environmental Consultants, Inc.

D. Section 321000 – Aggregate Materials.

E. Section 321123 - Aggregate Base Course.

F. Section 321313 – Concrete Paving.

1.4 REFERENCES

A. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

B. ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils.

C. ASTM D2216 – Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

D. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. ASTM D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

F. ASTM D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

G. ASTM D2041 – Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

H. ASTM D1188 – Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures.

I. ASTM D2726 – Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

J. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Specifications Publication 408, latest edition.

K. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Standards for Roadway Construction, Series RC 0 – 100.

L. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Publication 19 – Field Test Manual of Pennsylvania Test Methods (PTM).

M. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Publication 27 – Specifications for Bituminous Mixtures (Bulletin 27).

N. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Publication 37 – Specifications for Bituminous Materials (Bulletin 25).

O. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Publication 203 – Work Zone Traffic Control.

P. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Publication 34 – Aggregate Producers (Bulletin 14).

1.5 DEFINITIONS

A. Not used.

1.6 SUBMITTALS

A. The Owner or his representative shall receive copies of all test results and may request additional tests of the aggregate at no cost to the Owner.

B. The Contractor shall provide certifications from the suppliers of the aggregate and bituminous concrete materials to confirm that each material conforms to the applicable PennDOT Specification.

C. Submit asphaltic concrete mix designs for approval prior to commencing with paving activities.

D. Contractor to submit duplicate load slips stamped with the time the truck was loaded at the plant site.

1.7 REGULATORY REQUIREMENTS

A. Conform to applicable local code for paving work on private property.

B. Obtain required approvals and permits from the appropriate authority for the disposal of waste materials.

C. Contractor shall not obstruct or close any road or driveway without approval of the local governing authority and/or highway department.

D. Contractor shall not obstruct access to any fire hydrants without approval of the local fire department

1.8 COORDINATION

A. Placement of asphalt binder course shall not proceed until the aggregate base course has been completed.

B. Coordinate the work with the installation of the concrete curbs and sidewalks.

1.9 PROJECT RECORD DOCUMENTS

A. Not used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Bituminous Binder Course: The bituminous binder course shall satisfy the requirements of Section 409 of PennDOT Specifications Publication 408.

B. Bituminous Wearing Course: The bituminous wearing course shall satisfy the requirements of Section 409 of PennDOT Specifications Publication 408.

C. Bituminous Tack Coat: The bituminous tack coat shall satisfy the requirements of Section 460 of PennDOT Specifications Publication 408.

D. Striping: Painted pavement markings shall be formulated and manufactured from first-grade materials and shall be free from defects that may adversely affect the serviceability of the finished product. When the paint is stored in its container, the pigmented binder shall not settle out to the extent that re-mixing is difficult by standard methods or the application is detrimentally affected. Paint shall conform to the requirements of PennDOT Specifications Publication 408. Paint colors for handicap parking stalls shall satisfy the requirements of the Americans with Disabilities Act, the local jurisdictional authority, and the Owner. All paint (for striping) furnished must be shipped in strong, substantial, and properly sealed containers. All striping shall be 4-inch (minimum) wide and color as specified on the construction drawings.

E. Joint Sealer: Sealer materials shall be as specified in Section 705.4 (Joint Sealing Material) of PennDOT Specifications Publication 408.

F. Geotextile: A non-woven geotextile, if specified on the construction drawings, for the asphalt pavement section shall be composed of polypropylene yarns. The geotextile shall conform to Section 735 of PennDOT Specification Publication 408 for Class 4, Type A Geotextiles.

2.2 STORAGE AND HANDLING

A. Deliver, store, and handle geotextiles in accordance with the manufacturer's recommendations. During periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultraviolet rays, temperatures greater than 140 degrees Fahrenheit, mud, dirt, dust, and debris. The fabric shall be wrapped in a heavy covering or shielded from direct sunlight.

B. All paint shall be furnished in strong, substantial, and properly sealed containers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify subgrade is dry and has been compacted and proof rolled, and that gradients and elevations are correct immediately prior to placement of the geotextile, if required, and aggregate base course. Contractor shall maintain the pavement subgrade in good condition until placement of aggregate base course.

B. Verify that all curb work is complete, and all backfill placed, graded, and compacted immediately after the concrete curing period to avoid ponding water before any aggregate base course construction begins.

C. Verify the aggregate base course is dry and has been compacted, and that gradients and elevations are correct prior to placement of the binder course.

D. Verify that all frames, covers, grates, and all other miscellaneous castings located in the new pavement areas have been accurately positioned and set to the proper slope and elevation. All covers and grates shall be set flush with the required finish pavement surface. No depressions or mounds will be permitted to accommodate inaccuracies in the setting of these appurtenances.

E. The Contractor shall be required to maintain the subgrade and aggregate base course in good condition until the application of the bituminous concrete binder course. Maintenance shall include immediate repairs of any defects that may occur. Any damage occurring to the pavement subgrade, before and during paving operations, shall be corrected at the Contractor's expense.

3.2 PLACEMENT OF GEOTEXTILE

A. Place geotextile on the prepared subgrade prior to placement of the aggregate base course. Provide a minimum overlap of 12 inches between geotextile panels.

3.3 PLACING AGGREGATE BASE COURSE

A. Place base coarse aggregate in continuous, loose lifts on the prepared geotextile and in a manner to minimize segregation. Uncontrolled spreading from piles dumped on the subgrade resulting in segregation will not be permitted. If geotextile is damaged during placement of aggregate base course, the geotextile shall be replaced or completely covered by an additional layer of fabric. The loose lift thickness shall be a maximum of 10-inches. The loose layer thickness shall be kept within the compacting ability of the equipment used.

B. Level and contour surfaces to elevations and gradients indicated on the drawings.

C. Add water, if necessary, to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

D. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

E. Compact aggregate base course to at least 100% of its maximum dry density and within 3% of optimum moisture contents determined by ASTM D698, or until sufficient non-movement of the material is observed by the Owner or his representative under the weight of the compaction equipment. When an aggregate base course has been placed, but subsequent paving operations have been delayed so that the base has been disturbed by construction activities or frost action, the Contractor shall recompact or repair the base course prior to continuation of paving activities.

F. The Paving Contractor shall be required to maintain the aggregate base course in good condition until the application of the bituminous concrete binder course. Maintenance shall include immediate repairs of any defects that may occur. This work shall be done by the Paving Contractor at his own expense, and repeated as often as may be necessary to keep the area continuously intact.

3.4 PLACING ASPHALT PAVEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt surface course in lifts not exceeding recommended thicknesses per PennDOT Publication 408.

2. Spread mix at minimum temperature of 250 degrees F.

3. Begin applying mix along centerline of crown for crowned sections and on high side of one (1)-way slopes unless otherwise indicated.

4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt binder before placing asphalt wearing course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

D. If the wearing course is not placed immediately on top of the binder course, Contractor shall protect the binder course from precipitation. If water is allowed to come in contact with the binder course, it can soften and compromise the underlying aggregate base course and subgrade. If the aggregate base course or subgrade is damaged due to inadequate protection, the Contractor shall repair the aggregate base course, binder course, and subgrade at no additional cost to the Owner.

E. Do not run construction equipment on the binder course (except during placement of wearing course) or on the final wearing course. The pavement section was not designed to accommodate construction traffic. If the Contractor would like to run dump trucks or equipment on paved areas during construction, the contractor must notify CEC and the Owner. The Owner may opt, at its discretion, to allow construction traffic. However, the pavement sections will likely have to be redesigned. Allow a minimum of two (2) weeks for consideration of a request to allow construction traffic on pavement surfaces.

3.5 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 degrees F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: Greater than or equal to 92% and less than 97% of the daily maximum density.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.6 CONSTRUCTION JOINTS

A. At the end of each working day, a straight transverse and/or longitudinal construction joint shall be formed by cutting back into the completed work to form a true vertical face, which shall be properly maintained until the abutting section is completed. The finished pavement at joints shall comply with the surface smoothness requirements and exhibit the same uniformity of texture and compaction as other sections of the course. Rollers shall not pass over the unprotected edges of a freshly laid mixture.

In the formation of all joints, the exposed edge of the existing layer that will become part of the joint shall be the full thickness of the layer and straight. If the existing edge is unacceptable, the edge shall be corrected by using a power driven saw or other approved tools to cut a neat line. A light coat of bituminous material shall be applied to the existing pavement edges in order to provide a bond with the newly laid pavement.

1. Transverse Joints: The placing of the course shall be as continuous as possible. The transverse joint shall be formed by cutting back on the previous run to expose the full depth of the course.

2. Longitudinal Joints: Longitudinal joints in the surface wearing course shall correspond with the edges of proposed traffic lanes, unless otherwise directed by the Owner or his representative. The mixture shall be laid such that no more than 100 feet of pavement edge will be exposed at the end of the working day. An exposed edge of this type in excess of 100 feet may be permitted, provided that the edge is adequately protected against damage by vehicles and equipment

3.7 JOINT SEALING

A. Prepare and seal joints between bituminous and concrete surfaces, bituminous and bituminous surfaces, and bituminous and utility castings with a minimum 4-inch wide bituminous joint sealer applied in accordance with Section 705.4 of PennDOT Specifications Publication 408.

3.8 MEETING EXISTING PAVEMENTS

A. Where new pavements are to meet existing pavements, the Contractor shall line cut the existing pavements with approved pneumatic, saw cutting, or mechanical cutting tools so that there will be a vertical butting surface between the old and new pavements. There shall be a 1-foot offset in each pavement course to permit each successive course to overlap the lower existing course. Line cutting of existing pavements shall be along neat,

straight, and even lines, and shall be performed in such a manner so as not to damage the adjacent pavement, which is to remain.

3.9 VERTICAL SURFACES IN CONTACT WITH BITUMINOUS MIXTURES

A. All vertical surfaces of curbs, structures, gutters, and existing pavement in contact with new bituminous mixtures shall be painted with a uniform coating of an approved bituminous emulsion or priming material. Extreme care shall be exercised in the application of this material to prevent splattering or staining of surfaces that are to remain exposed. Work that is stained as a result of the Contractor's operations shall be repaired and/or replaced at the Contractor's expense.

3.10 STRIPING

A. The Contractor shall clean the pavement of any and all dust, dirt, old pavement markings, concrete curing compounds, and other foreign material, which may be detrimental to the adhesion of the striping.

B. The striping shall be applied only on thoroughly dry pavement surfaces, when the atmospheric temperature is at or above 60 degrees Fahrenheit for plastic striping and markings and 40 degrees Fahrenheit for paint striping and markings, and when the weather is otherwise favorable.

C. Painted pavement markings shall be applied with atomizing spray type striping machines. The equipment shall be compatible with and suitable for the application of the type of paint being used and shall have clean-cut edges, true and smooth alignment, and uniform film thickness of 15 +1 mils.

D. The Contractor shall apply, for handicap symbols, white, yellow, and/or blue paint (as required by the local jurisdiction in authority and the Americans with Disabilities Act), utilizing rollers and/or brushes for marking turn arrows, letters, stop bars, handicap stalls, etc. Normal spreading rates for pavement marking paints shall be from 100 to 115 square feet per gallon so as to obtain a wet film thickness of 15 +1 mils.

E. Existing pavement markings that are to be removed shall be removed in an approved manner that will cause the least damage to the pavement surface. Removal by painting over with black paint is not acceptable.

F. The Contractor shall remove tracking marks, spilled paint, or striping applied incorrectly or in unauthorized areas.

G. One (1) coat of pavement striping shall be applied unless otherwise specified on the plans and specification.

3.11 DISPOSAL

A. Removed excess material not being reused shall be disposed of off-site in an approved waste facility

3.12 TOLERANCES

A. Aggregate Base Course:

Flatness: Maximum variation of 1/4 inch as measured with a 10-foot long straight edge.
Scheduled Compacted Thickness: Within 1/4 inch.
Variation from True Elevation: Plus or minus 1/10 foot.

B. Asphalt Pavement:

Flatness: Maximum variation of 1/6 inch as measured with a 10-foot long straight edge.
Scheduled Compacted Thickness: Within 1/8 inch.
Variation from True Elevation: Plus or minus 1/100 foot.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. All equipment shall be in first-class operating condition for the duration of the paving activities.

C. The Owner or his representative shall visually observe to verify that compacted lift thicknesses for the aggregate base course do not exceed 8 inches.

D. Owner's Testing Agency shall perform compaction testing of the aggregate base course and asphalt pavement in accordance with ASTM D2216, ASTM D2922, and/or ASTM D3017. The pavement subgrade shall be proof rolled prior to placement of the geotextile and aggregate base using a fully loaded (25 ton) pneumatic-tired dump truck. Areas displaying elasticity should be overexcavated to suitable material and replaced with properly compacted fill materials.

E. The Owner or his representative shall visually observe the aggregate base course to verify that a firm unyielding foundation with no sudden, sharp, or abrupt changes or break in grades shall exist after compaction.

F. In-Place Density: Testing Agency will take samples of uncompacted paving mixtures for determination of theoretical maximum density.

1. Reference maximum theoretical density will be determined by averaging results from four (4) samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726.

a. Contractor shall provide to testing agency one (1) core sample for every 1000 sq. yd. or less of installed pavement, with no fewer than three (3) cores taken.

b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726.

G. Frequency of Tests: Perform in-place density and moisture content tests (where applicable) for every 1,000 square yards of paving, or at least once per day of paving operations, at a minimum or as directed by the Owner or his representative.

H. If tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest, at no cost to the Owner

3.14 QUALITY ASSURANCE

A. Perform Work in accordance with Section 409 (Superpave Mixture Design, Standard and RPS Construction of Plant-Mixed HMA Courses) of PennDOT Specifications Publication 408.

B. Mixing Plant: As approved by the Owner.

C. Obtain materials from same source throughout.

D. Provide representative samples of proposed aggregate base course to Owner's Testing Agency a minimum of one (1) week prior to placing aggregate base course. Owner's Testing Agency shall perform laboratory tests of aggregate to determine the maximum density and optimum moisture content in accordance with ASTM D698.

E. Owner's Testing Agency shall perform laboratory sieve analysis of aggregate in accordance with ASTM D422 to determine if the percentages of aggregate meet the gradation requirements for PennDOT 2A aggregate.

F. Visually observe aggregate to verify that it meets the project description.

G. If tests indicate aggregate does not meet specified requirements, change material and retest, at no cost to the Owner.

3.15 TEMPERATURE REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees Fahrenheit, or surface is wet or frozen.

3.16 PROTECTION OF FINISHED WORK

A. Immediately after placement of asphalt wearing course, protect pavement from mechanical injury until adequate stability and adhesion have been attained and the material has cooled to 140 degrees Fahrenheit or less.

B. Provide barricades and/or flagmen to protect workers and the public where necessary.

3.17 DEFECTIVE WORK

A. Defective areas shall be removed, subgrade recompacted and area repaved, unless otherwise directed by the Owner or Owner’s representative at no additional cost to the owner.

END OF SECTION 321216

APPENDIX – XRF LEAD-BASED PAINT INSPECTION AND LIMITED ASBESTOS RENOVATION SURVEY

Mid-Atlantic Environmental Consultants

IRWIN BOROUGH BUILDING
424 MAIN STREET
IRWIN, PENNSYLVANIA
(WESTMORELAND COUNTY)



XRF LEAD-BASED PAINT INSPECTION

MID ATLANTIC JOB NUMBER: CEC-25-03

APRIL 2025

PREPARED FOR:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
700 CHERRINGTON PARKWAY
MOON TOWNSHIP, PA 15108

PREPARED BY:

MID ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
5320 N. PIONEER ROAD
GIBSONIA, PA 15044
(724) 444-3460 – OFFICE
(724) 444-3463 – FAX
midatlantic@zoominternet.net – EMAIL

Mid-Atlantic Environmental Consultants

5320 N. Pioneer Road
Gibsonia, PA 15044
Phone: 724-444-3460
Fax: 724-444-3463
Email: midatlantic@zoominternet.net

March 30th, 2025

Civil & Environmental Consultants, Inc.
700 Cherrington Parkway
Moon Township, Pa 15108

Attn: Mr. Scott Maritzer

Re: Summary of Lead-Based Paint XRF Testing

To Whom It May Concern:

On Wednesday, March 19th, 2025, Mid Atlantic Environmental Consultants, Inc. performed XRF Instrumentation testing of suspected lead-based paint at the Irwin Borough Building located at 424 Main Street, Irwin, Pennsylvania (Westmoreland County). The purpose of this XRF testing was to identify the potential presence of lead-based paint that may exist on surfaces of accessible building components/structures within the subject building. All suspect lead-based painted building components/structures were analyzed utilizing a handheld VIKEN DETECTION MODEL Pb200e XRF instrument. A suspect lead-based paint testing report indicating the results of the investigation is enclosed.

Mid Atlantic Environmental Consultants Inc. appreciates the opportunity to assist Civil & Environmental Consultants, Inc. with this project and looks forward to collaborating with you on future assignments. Should you have any further questions or concerns, do not hesitate to contact us by phone at: (724) 444-3460 or by email at: midatlantic@zoominternet.net.

Sincerely,

Nazeer Elahee

Nazeer Elahee
Penna. Certified Lead Risk Assessor
License No. PA006975

Timothy E. Daniels

Timothy E. Daniels
Managing Partner

424 MAIN STREET – IRWIN, PENNSYLVANIA

Mid Atlantic Environmental Consultants, Inc. was retained by Civil & Environmental Consultants (CEC) to conduct an XRF lead-based paint survey & associated testing of a building located at 424 Main Street in Irwin, Pennsylvania (Allegheny County). On Wednesday, March 19th, 2025, Mid-Atlantic representative Mr. Nazeer Elahee, an EPA/Pennsylvania Lead Certified Risk Assessor, conducted the XRF suspect lead-based paint testing. Mid Atlantic representative Mr. Mike Pirro assisted Mr. Elahee during this suspect lead-based paint investigation.

This inspection was performed in accordance with applicable Federal, State, and Local Regulations. All XRF sample testing data is presented in Appendix A (XRF Spreadsheets). As stated, the purpose of this XRF testing was to identify the potential presence of any lead-based paint that may exist on surfaces of accessible building components/ structures. Efforts were made to examine representative surfaces; however, MAEC cannot be held responsible for materials in inaccessible areas such as locked rooms, locked vaults, locked crawlspaces, enclosed walls & ceiling cavities, etc.

A lead-based paint is identified as any material containing equal to or greater than one milligram per centimeter squared (>1mg/cm²) of lead, or greater than 0.5% of lead by weight, or more than 5,000 parts per million (ppm) of lead as defined by the U.S. Department of Housing and Urban Development (HUD). Please be advised that this XRF survey/testing was not performed in accordance with HUD protocol.

Building components were sampled by utilizing an X-Ray Fluorescence instrument (XRF). Mid Atlantic utilizes a VIKEN DETECTION MODEL Pb200e - 3522 with a cobalt 57 radioactive source.

A total of one-hundred-twenty-five (125) surfaces were sampled, omitting calibration checks and null readings. Of those samples, thirty-eight (38) were found to contain a lead concentration greater than the established HUD guidelines.

Please note, painted surfaces that contain levels of lead below 1.0 mg/cm², could create lead dust or lead-contaminated soil hazards if the paint is turned into dust by abrasion, scraping, or sanding. It should be noted for employee safety purposes that OSHA does not define lead-based paint and therefore paint with any lead content whatsoever is considered a worker hazard. This report should be kept by the owner and all future owners for the life of the building.

Please refer to the XRF spreadsheets in Appendix A for a complete listing of materials tested and XRF results.

Refer to the appendices for further information.

Appendix A - XRF Lead Inspection Results

Appendix B - XRF Sample Location Diagrams

Appendix C - XRF Sample Photo Log

Appendix D - XRF Performance Characteristic Sheets

Appendix E - Certifications / Licensing

Should you have any further questions, feel free to contact our office at (724) 444-3460 or email at midatlantic@zoominternet.net.

APPENDIX A

XRF Lead Inspection Results

Mid-Atlantic Environmental Consultants

5320 N. Pioneer Road
Gibsonia, PA 15044
Phone: 724-444-3460 Fax: 724-444-3463

Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
1	Calibration	1.1	
2	Calibration	1.0	
3	Calibration	1.2	
4	Beige / 2nd Floor Work Area - Wall D	19.7	YES
5	Beige / 2nd Floor Window Casing D	3.3	YES
6	Beige / Chair Rail D	7.5	YES
7	Beige / 2nd Floor Work Area - Wall C	0.1	NO
8	Biege / Door Casing C	0.6	NO
9	Biege / Door	0.5	NO
10	Beige / Wall B	0.1	NO
11	Beige / Window Casing B	3.5	YES
12	Beige / Chair Rail B	7.5	YES

Definition of Lead-based paint: Paint, varnish, shellac, or other surface coatings that contain 1.0 mg/cm\2 or more of lead or are 0.5% lead by weight.

Mid-Atlantic Environmental Consultants

5320 N. Pioneer Road
Gibsonia, PA 15044
Phone: 724-444-3460 Fax: 724-444-3463

Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
13	Beige / 2nd Floor File Storage Area - Heater Unit	0.1	NO
14	Beige / 2nd Floor File Storage Area - Ceiling	6.6	YES
15	Beige / 2nd Floor File Storage Area - Acces to Roof Door Frame	0.8	NO
16	Beige / 2nd Floor File Storage Area - Wall A	0.2	NO
17	Beige / 2nd Floor File Storage Area - Wall B	0.1	NO
18	Beige / 2nd Floor File Storage Area - Wall C	4.6	YES
19	Beige / 2nd Floor File Storage Area - Wall D	5	YES
20	Beige / 2nd Floor File Storage Area - Door	0.2	NO
21	Beige / 2nd Floor File Storage Area - Window Casing	1.9	YES
22	Beige / 2nd Floor File Storage Area - Book Shelf	0.0	NO
23	2nd Floor Work Area - Door Casing A	0.3	NO
24	2nd Floor Front Storage - Wall A	22.8	YES

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Mid-Atlantic Environmental Consultants

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Gibsonia, PA 15044
Phone: 724-444-3460 Fax: 724-444-3463

Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
25	Beige / 2nd Floor Front Storage - Wall B	19.5	YES
26	Beige / 2nd Floor Front Storage - Wall C	0.0	NO
27	Beige / 2nd Floor Front Storage - Wall D	0.0	NO
28	Beige / 2nd Floor Front Storage - Window Casing	5.0	YES
29	Beige / 2nd Floor Front Storage - Chair Rail	6.9	YES
30	Beige / 2nd Floor Front Storage - Heater Unit	0.2	NO
31	Beige / 2nd Floor Work Area - Drain Pipe	0.2	NO
32	Beige / 2nd Floor Work Area / Upper Wall Trim	5.1	YES
33	White / Appliance Store - Display Area Ceiling	0.1	NO
34	White / Apliance Store - Wall B	28	YES
35	White / Appliance Store - Wall D- Drywall Section	0.1	NO
36	White / Appliance Store - Wall D- Plaster Section	12.1	YES

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Phone: 724-444-3460 Fax: 724-444-3463

Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
37	Blue / Appliance Store - Wood Trim	0.0	NO
38	White / Appliance Store Men's Room - Wall D	14.1	YES
39	White / Appliance Store Men's Room - Wall A	0.0	NO
40	White / Appliance Store Men's Room - Wall C	0.2	NO
41	White / Appliance Store Men's Room - Wall B	0.1	NO
42	White / Appliance Store Men's Room - Door Casing	0.0	NO
43	White / Appliance Store Hallway - Ceiling	0.0	NO
44	White / Appliance Store Hallway - Wall B	0.4	NO
45	White / Appliance Store Hallway - Heater Unit	0.2	NO
46	White / Appliance Store Women's Room - Wall D	10.9	YES
47	White / Appliance Store Women's Room - Wall A	0.0	NO
48	White / Appliance Store Women's Room - Wall B	0.0	NO

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Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
49	White / Appliance Store Women's Room - Wall C	0.0	NO
50	White / Appliance Store Women's Room - Ceiling	0.2	NO
51	White / Appliance Store Women's Room - Door Casing	0.0	NO
52	White / Appliance Store Office - Wall B	0.0	NO
53	White / Appliance Store - Wall C	0.1	NO
54	White / Appliance Store Rear Stairs - Wall A	0.3	NO
55	White / Appliance Store Rear Stairs - Wall C	3.5	YES
56	White / Appliance Store Rear Stairs - Ceiling	0.0	NO
57	Blue / Appliance Store Rear Stairs - Stair Rail	0.1	NO
58	Blue / Appliance Store Rear Stairs - Stair Rail	0.1	NO
59	Gray / Appliance Store Exterior Front - Post	0.3	NO
60	Tan / Appliance Store Exterior Front - Wall A	0.2	NO

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Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
61	White / Appliance Store Exterior Front - Ceiling	0.0	NO
62	Brown / Appliance Store Exterior Front - Wood Trim	0.0	NO
63	Silver / Appliance Store Boiler Room - Wall A	0.2	NO
64	Silver / Appliance Store Boiler Room - Wall B	0.0	NO
65	Silver / Appliance Store Boiler Room - Wall C	0.0	NO
66	Silver / Appliance Store Boiler Room - Wall D	21.1	YES
67	Silver / Appliance Store Boiler Room - Ceiling	0.2	NO
68	Silver / Appliance Store Boiler Room - 4" Boiler Pipe	0.0	NO
69	Blue/ Appliance Store Boiler Room - Door Casing	0.6	NO
70	Gray / Appliance Store Boiler Room	0.2	NO
71	Green / Appliance Store Front Room - Wall A	6.2	YES
72	Green / Appliance Store Front Room - Wall B	0.0	NO

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Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
85	Green / Appliance Store Basement Main Area - Ceiling	0.6	NO
86	Green / Appliance Store Basement Main Area - Ceiling Beam	0.5	NO
87	Green / Appliance Store Basement Main Area - Wall C	0.0	NO
88	Green / Appliance Store Basement Main Area - 2" Pipe	0.1	NO
89	Black / Appliance Store Basement - Electric Panel	0.1	NO
90	Tan / Police Department Basement Office - Wall A	0.3	NO
91	Tan / Police Department Basement Office - Wall B	0.6	NO
92	White / Police Department Basement Office - Window Casing	0.2	NO
93	White / Police Department Basement Office - Window Sill	0.2	NO
94	White / Police Department Basement Office - Window Apron	0.3	NO
95	Stain / Police Department Basement Office - Closet Casing	0.0	NO
96	Tan / Police Department Basement Office - Closet Wall	0.0	NO

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Mid-Atlantic Environmental Consultants

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Phone: 724-444-3460 Fax: 724-444-3463

Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
97	Red / Police Department Basement Office - Floor	7.7	YES
98	White / Police Department Basement Office - Ceiling	3.4	YES
99	White / Police Department Basement Office - Ceiling Beam	4.3	YES
100	White / Police Department Basement Office - 3" Pipe	0.0	NO
101	White / Police Department Basement Storage Cell - Wall A	7.7	YES
102	White / Police Department Basement Storage Cell - Wall B	5.5	YES
103	White / Police Department Basement Storage Cell - Wall D	5.8	YES
104	Silver / Police Department Basement Storage Cell - 3" Pipe	1.7	YES
105	Silver / Police Department Basement Storage Cell - Door	0.1	NO
106	Blue / Police Department Basement Storage Cell - Ceiling	0.2	NO
107	Blue / Police Department Basement - 2" Pipe	6.9	YES
108	Blue / Police Department Basement - Window Sash	1.6	YES

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Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
109	Blue / Police Department Basement Jail Cell Area - Window Sill	9.1	YES
110	Blue / Police Department Basement Jail Cell Area - Window Apron	7.7	YES
111	Blue / Police Department Basement Jail Cell Area - 2" Pipe	2.6	YES
112	Blue / Police Department Basement Jail Cell Area - Cell Door	0.4	NO
113	Blue / Police Department Basement Jail Cell Area - Floor	0.1	NO
114	Blue / Police Department Basement Jail Cell Area - Wall B	2.3	YES
115	Blue / Police Department Basement Jail Cell Area - Wall D	2.8	YES
116	Silver / Police Department Basement Jail Cell Area - Heater Unit	0.1	NO
117	White / Police Department Entrance Area - Wall A	0.0	NO
118	White / Police Department Entrance Area - Wall C	0.0	NO
119	Gray / Police Department Entrance Area - Stair Rail	0.2	NO
120	Gray / Police Department Entrance Area - Stair Riser	0.2	NO

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Lead (Pb) XRF Results

Project: 424 Main Street, Irwin, PA
Client: CEC
Date: 3/19/25
Mid Atlantic Job Number: CEC-25-03

Sample	Color / Description	Results mg / cm2	Lead – based paint
121	White / Police Department Entrance Area - Stair Wall A	0.0	NO
122	White / Police Department Entrance Area - Stair Wall D	0.0	NO
123	White / Police Department Entrance Area - Heater Unit	0.1	NO
124	Gray / Police Department Entrance Area - Window Sill	0.2	NO
125	Gray / Police Department Entrance Area - Window Apron	0.1	NO
126	Gray / Police Department Entrance Area - Baseboard	0.2	NO
127	White / Police Department Entrance Area - Stoop Ceiling	0.2	NO
128	White / Police Department Entrance Area - Stoop Lentel	0.1	NO
129	Calibration	1.1	
130	Calibration	0.8	
131	Calibration	0.8	
	END OF READINGS		

Definition of Lead-based paint: Paint, varnish, shellac, or other surface coatings that contain 1.0 mg/cm\2 or more of lead or are 0.5% lead by weight.

Company Viken Detection
Model Pb200i
Type XRF Lead Paint Analyzer
Serial Num. 3522
App Version Pb200i-5.3.1

424 Main Street, Irwin, PA 15642

Job Id	Reading #	Concentration	Units	Result	Action Level	Date	Time	User	Mode	Analytic Mode	Structure	Substrate	Location	Condition	Color
CEC-25-03	1	1.1	mg/cm2	Positive	1	3/19/2025	10:13:42	nazeer	Action Level	Lead Paint	Calibration				
CEC-25-03	2	1	mg/cm2	Positive	1	3/19/2025	10:14:13	nazeer	Action Level	Lead Paint	Calibration				
CEC-25-03	3	1.2	mg/cm2	Positive	1	3/19/2025	10:14:35	nazeer	Action Level	Lead Paint	Calibration				
CEC-25-03	4	19.7	mg/cm2	Positive	1	3/19/2025	10:16:07	nazeer	Action Level	Lead Paint	Wall D	Plaster	2nd Floor - Work Area	Poor	Beige
CEC-25-03	5	3.3	mg/cm2	Positive	1	3/19/2025	10:17:32	nazeer	Action Level	Lead Paint	Window Casing	Wood	2nd Floor - Work Area	Good	Beige
CEC-25-03	6	7.5	mg/cm2	Positive	1	3/19/2025	10:18:16	nazeer	Action Level	Lead Paint	Chair Rail	Wood	2nd Floor - Work Area	Good	Beige
CEC-25-03	7	0.1	mg/cm2	Negative	1	3/19/2025	10:19:12	nazeer	Action Level	Lead Paint	Wall C	Plaster	2nd Floor - Work Area	Poor	Beige
CEC-25-03	8	0.6	mg/cm2	Negative	1	3/19/2025	10:20:29	nazeer	Action Level	Lead Paint	Door Casing	Wood	2nd Floor - Work Area	Good	Beige
CEC-25-03	9	0.5	mg/cm2	Negative	1	3/19/2025	10:20:50	nazeer	Action Level	Lead Paint	Door	Metal	2nd Floor - Work Area	Good	Beige
CEC-25-03	10	0.1	mg/cm2	Negative	1	3/19/2025	10:21:37	nazeer	Action Level	Lead Paint	Wall B	Plaster	2nd Floor - Work Area	Good	Beige
CEC-25-03	11	3.5	mg/cm2	Positive	1	3/19/2025	10:22:58	nazeer	Action Level	Lead Paint	Window Casing	Wood	2nd Floor - Work Area	Good	Beige
CEC-25-03	12	7.5	mg/cm2	Positive	1	3/19/2025	10:23:46	nazeer	Action Level	Lead Paint	Chair Rail	Wood	2nd Floor - Work Area	Good	Beige
CEC-25-03	13	0.1	mg/cm2	Negative	1	3/19/2025	10:24:36	nazeer	Action Level	Lead Paint	Heater Unit	Metal	2nd Floor - Work Area	Good	Beige
CEC-25-03	14	6.6	mg/cm2	Positive	1	3/19/2025	10:27:12	nazeer	Action Level	Lead Paint	Ceiling	Plaster	2nd Floor - File Storage	Good	Beige
CEC-25-03	15	0.8	mg/cm2	Negative	1	3/19/2025	10:27:41	nazeer	Action Level	Lead Paint	Access Door Frame to Roof	Wood	2nd Floor - File Storage	Good	Beige
CEC-25-03	16	0.2	mg/cm2	Negative	1	3/19/2025	10:30:24	nazeer	Action Level	Lead Paint	Wall A	Plaster	2nd Floor - File Storage	Good	Beige
CEC-25-03	17	0.1	mg/cm2	Negative	1	3/19/2025	10:30:41	nazeer	Action Level	Lead Paint	Wall B	Plaster	2nd Floor - File Storage	Good	Beige
CEC-25-03	18	4.6	mg/cm2	Positive	1	3/19/2025	10:31:05	nazeer	Action Level	Lead Paint	Wall C	Plaster	2nd Floor - File Storage	Good	Beige
CEC-25-03	19	5	mg/cm2	Positive	1	3/19/2025	10:31:28	nazeer	Action Level	Lead Paint	Wall D	Plaster	2nd Floor - File Storage	Good	Beige
CEC-25-03	20	0.2	mg/cm2	Negative	1	3/19/2025	10:32:22	nazeer	Action Level	Lead Paint	Door Casing	Wood	2nd Floor - File Storage	Good	Beige
CEC-25-03	21	1.9	mg/cm2	Positive	1	3/19/2025	10:33:23	nazeer	Action Level	Lead Paint	Window Casing	Wood	2nd Floor - File Storage	Good	Beige
CEC-25-03	22	0	mg/cm2	Negative	1	3/19/2025	10:35:11	nazeer	Action Level	Lead Paint	Book Shelf	Wood	2nd Floor - File Storage	Good	Beige
CEC-25-03	23	0.3	mg/cm2	Negative	1	3/19/2025	10:37:59	nazeer	Action Level	Lead Paint	Door Casing	Wood	2nd Floor - Work Area	Good	Beige
CEC-25-03	24	22.8	mg/cm2	Positive	1	3/19/2025	10:39:50	nazeer	Action Level	Lead Paint	Wall A	Plaster	2nd Floor - Front Storage	Good	Beige
CEC-25-03	25	19.5	mg/cm2	Positive	1	3/19/2025	10:40:57	nazeer	Action Level	Lead Paint	Wall B	Plaster	2nd Floor - Front Storage	Good	Beige
CEC-25-03	26	0	mg/cm2	Negative	1	3/19/2025	10:41:19	nazeer	Action Level	Lead Paint	Wall C	Plaster	2nd Floor - Front Storage	Good	Beige
CEC-25-03	27	0	mg/cm2	Negative	1	3/19/2025	10:41:33	nazeer	Action Level	Lead Paint	Wall D	Plaster	2nd Floor - Front Storage	Good	Beige
CEC-25-03	28	5	mg/cm2	Positive	1	3/19/2025	10:42:26	nazeer	Action Level	Lead Paint	Window Casing	Wood	2nd Floor - Front Storage	Good	Beige
CEC-25-03	29	6.9	mg/cm2	Positive	1	3/19/2025	10:42:42	nazeer	Action Level	Lead Paint	Chair Rail	Wood	2nd Floor - Front Storage	Good	Beige
CEC-25-03	30	0.2	mg/cm2	Negative	1	3/19/2025	10:43:10	nazeer	Action Level	Lead Paint	Heater Unit	Metal	2nd Floor - Front Storage	Good	Beige
CEC-25-03	31	0.2	mg/cm2	Negative	1	3/19/2025	10:45:36	nazeer	Action Level	Lead Paint	Drain Pipe	Metal	2nd Floor - Work Area	Good	Beige
CEC-25-03	32	5.1	mg/cm2	Positive	1	3/19/2025	10:53:15	nazeer	Action Level	Lead Paint	Upper Wall Trim	Wood	2nd Floor - Work Area	Good	Beige
CEC-25-03	33	0.1	mg/cm2	Negative	1	3/19/2025	11:11:08	nazeer	Action Level	Lead Paint	Display Area Ceiling	Plaster	Appliance Store	Good	White
CEC-25-03	34	28	mg/cm2	Positive	1	3/19/2025	11:13:46	nazeer	Action Level	Lead Paint	Wall B	Plaster	Appliance Store	Good	White
CEC-25-03	35	0.1	mg/cm2	Negative	1	3/19/2025	11:15:01	nazeer	Action Level	Lead Paint	Wall D	Drywall	Appliance Store	Good	White

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Job Id	Reading #	Concentration	Units	Result	Action Level	Date	Time	User	Mode	Analytic Mode	Structure	Substrate	Location	Condition	Color
CEC-25-03	36	12.1	mg/cm2	Positive	1	3/19/2025	11:17:13	nazeer	Action Level	Lead Paint	Wall D	Plaster	Appliance Store	Good	White
CEC-25-03	37	0	mg/cm2	Negative	1	3/19/2025	11:18:58	nazeer	Action Level	Lead Paint	Trim	Wood	Appliance Store	Good	Blue
CEC-25-03	38	14.1	mg/cm2	Positive	1	3/19/2025	11:28:47	nazeer	Action Level	Lead Paint	Wall D	Plaster	Appliance Store Mens Room	Good	White
CEC-25-03	39	0	mg/cm2	Negative	1	3/19/2025	11:29:16	nazeer	Action Level	Lead Paint	Wall A	Plaster	Appliance Store Mens Room	Good	White
CEC-25-03	40	0.2	mg/cm2	Negative	1	3/19/2025	11:29:47	nazeer	Action Level	Lead Paint	Wall C	plaster	Appliance Store Mens Room	Good	White
CEC-25-03	41	0.1	mg/cm2	Negative	1	3/19/2025	11:30:14	nazeer	Action Level	Lead Paint	Wall B	plaster	Appliance Store Mens Room	Good	White
CEC-25-03	42	0	mg/cm2	Negative	1	3/19/2025	11:30:34	nazeer	Action Level	Lead Paint	Closet Door Casing	Wood	Appliance Store Mens Room	Good	White
CEC-25-03	43	0	mg/cm2	Negative	1	3/19/2025	11:31:05	nazeer	Action Level	Lead Paint	Ceiling	Drywall	Appliance Store Hall	Good	White
CEC-25-03	44	0.4	mg/cm2	Negative	1	3/19/2025	11:31:57	nazeer	Action Level	Lead Paint	Wall B	Drywall	Appliance Store Hall	Good	White
CEC-25-03	45	0.2	mg/cm2	Negative	1	3/19/2025	11:32:46	nazeer	Action Level	Lead Paint	Heater Unit	Metal	Appliance Store Hall	Good	White
CEC-25-03	46	10.9	mg/cm2	Positive	1	3/19/2025	11:33:39	nazeer	Action Level	Lead Paint	Wall D	Drywall	Appliance Store Womens Room	Good	White
CEC-25-03	47	0	mg/cm2	Negative	1	3/19/2025	11:34:04	nazeer	Action Level	Lead Paint	Wall A	Drywall	Appliance Store Womens Room	Good	White
CEC-25-03	48	0	mg/cm2	Negative	1	3/19/2025	11:34:45	nazeer	Action Level	Lead Paint	Wall B	Drywall	Appliance Store Womens Room	Good	White
CEC-25-03	49	0	mg/cm2	Negative	1	3/19/2025	11:35:46	nazeer	Action Level	Lead Paint	Wall C	Drywall	Appliance Store Womens Room	Good	White
CEC-25-03	50	0.2	mg/cm2	Negative	1	3/19/2025	11:36:22	nazeer	Action Level	Lead Paint	Ceiling	Drywall	Appliance Store Womens Room	Good	White
CEC-25-03	51	0	mg/cm2	Negative	1	3/19/2025	11:37:02	nazeer	Action Level	Lead Paint	Door Casing	Wood	Appliance Store Womens Room	Good	White
CEC-25-03	52	0	mg/cm2	Negative	1	3/19/2025	11:38:22	nazeer	Action Level	Lead Paint	Wall B	Plaster	Appliance Store Office	Good	White
CEC-25-03	53	0.1	mg/cm2	Negative	1	3/19/2025	11:39:05	nazeer	Action Level	Lead Paint	Wall C	Plaster	Appliance Store Office	Good	White
CEC-25-03	54	0.3	mg/cm2	Negative	1	3/19/2025	11:44:05	nazeer	Action Level	Lead Paint	Wall A	Plaster	Appliance Store Rear Stairs	Good	White
CEC-25-03	55	3.5	mg/cm2	Positive	1	3/19/2025	11:44:26	nazeer	Action Level	Lead Paint	Wall C	Plaster	Appliance Store Rear Stairs	Good	White
CEC-25-03	56	0	mg/cm2	Negative	1	3/19/2025	11:44:54	nazeer	Action Level	Lead Paint	Ceiling	Plaster	Appliance Store Rear Stairs	Good	White
CEC-25-03	57	0.1	mg/cm2	Negative	1	3/19/2025	11:45:41	nazeer	Action Level	Lead Paint	Stair Rail	Metal	Appliance Store Rear Stairs	Good	Blue
CEC-25-03	58	0.1	mg/cm2	Negative	1	3/19/2025	11:46:32	nazeer	Action Level	Lead Paint	Stair Riser	Metal	Appliance Store Rear Stairs	Good	Blue
CEC-25-03	59	0.3	mg/cm2	Negative	1	3/19/2025	12:36:28	nazeer	Action Level	Lead Paint	Post	Metal	Appliance Store Exterior Front	Poor	Gray
CEC-25-03	60	0.2	mg/cm2	Negative	1	3/19/2025	12:36:49	nazeer	Action Level	Lead Paint	Wall A	Stucco	Appliance Store Exterior Front	Good	Tan
CEC-25-03	61	0	mg/cm2	Negative	1	3/19/2025	12:39:46	nazeer	Action Level	Lead Paint	Ceiling	Concrete	Appliance Store Exterior Front	Good	White
CEC-25-03	62	0	mg/cm2	Negative	1	3/19/2025	12:40:12	nazeer	Action Level	Lead Paint	Wood Trim	Wood	Appliance Store Exterior Front	Poor	Brown
CEC-25-03	63	0.2	mg/cm2	Negative	1	3/19/2025	12:59:46	nazeer	Action Level	Lead Paint	Wall A	Brick	Applicance Store Boiler Room	Good	Silver
CEC-25-03	64	0	mg/cm2	Negative	1	3/19/2025	13:00:02	nazeer	Action Level	Lead Paint	Wall B	Brick	Applicance Store Boiler Room	Good	Silver
CEC-25-03	65	0	mg/cm2	Negative	1	3/19/2025	13:00:18	nazeer	Action Level	Lead Paint	Wall C	Brick	Applicance Store Boiler Room	Good	Silver
CEC-25-03	66	21.1	mg/cm2	Positive	1	3/19/2025	13:00:37	nazeer	Action Level	Lead Paint	Wall D	Brick	Applicance Store Boiler Room	Good	Silver
CEC-25-03	67	0.2	mg/cm2	Negative	1	3/19/2025	13:01:36	nazeer	Action Level	Lead Paint	Ceiling	Concrete	Applicance Store Boiler Room	Good	Silver
CEC-25-03	68	0	mg/cm2	Negative	1	3/19/2025	13:03:43	nazeer	Action Level	Lead Paint	4" Boiler Pipe	Metal	Applicance Store Boiler Room	Good	Silver
CEC-25-03	69	0.6	mg/cm2	Negative	1	3/19/2025	13:07:46	nazeer	Action Level	Lead Paint	Door Casing	Metal	Applicance Store Boiler Room	Good	Blue
CEC-25-03	70	0.2	mg/cm2	Negative	1	3/19/2025	13:08:40	nazeer	Action Level	Lead Paint	Door Jamb	Metal	Applicance Store Boiler Room	Poor	Gray
CEC-25-03	71	6.2	mg/cm2	Positive	1	3/19/2025	13:09:51	nazeer	Action Level	Lead Paint	Wall A	Concrete	Appliance Store Base - Front Room	Poor	Green
CEC-25-03	72	0	mg/cm2	Negative	1	3/19/2025	13:11:05	nazeer	Action Level	Lead Paint	Wall B	Concrete	Appliance Store Base - Front Room	Poor	Gray
CEC-25-03	73	0.1	mg/cm2	Negative	1	3/19/2025	13:13:13	nazeer	Action Level	Lead Paint	Ceiling Beam	Concrete	Appliance Store Base - Front Room	Poor	Gray
CEC-25-03	74	5.6	mg/cm2	Positive	1	3/19/2025	13:14:05	nazeer	Action Level	Lead Paint	Ceiling	Concrete	Appliance Store Base - Front Room	Poor	Gray
CEC-25-03	75	0.4	mg/cm2	Negative	1	3/19/2025	13:14:29	nazeer	Action Level	Lead Paint	Colum	Concrete	Appliance Store Base - Front Room	Poor	Gray

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Job Id	Reading #	Concentration	Units	Result	Action Level	Date	Time	User	Mode	Analytic Mode	Structure	Substrate	Location	Condition	Color
CEC-25-03	76	0.1	mg/cm2	Negative	1	3/19/2025	13:15:55	nazeer	Action Level	Lead Paint	Door Casing	Metal	Appliance Store Base - Front Room	Poor	Gray
CEC-25-03	77	0.1	mg/cm2	Negative	1	3/19/2025	13:16:10	nazeer	Action Level	Lead Paint	Door	Metal	Appliance Store Base - Front Room	Good	Gray
CEC-25-03	78	0	mg/cm2	Negative	1	3/19/2025	13:19:46	nazeer	Action Level	Lead Paint	Wall A	Plaster	Appliance Store Base - Front Storage	Poor	Tan
CEC-25-03	79	0.4	mg/cm2	Negative	1	3/19/2025	13:20:08	nazeer	Action Level	Lead Paint	Wall B	Plaster	Appliance Store Base - Front Storage	Poor	Tan
CEC-25-03	80	0.2	mg/cm2	Negative	1	3/19/2025	13:20:33	nazeer	Action Level	Lead Paint	Wall C	Plaster	Appliance Store Base - Front Storage	Poor	Tan
CEC-25-03	81	0	mg/cm2	Negative	1	3/19/2025	13:20:51	nazeer	Action Level	Lead Paint	Wall D	Plaster	Appliance Store Base - Front Storage	Poor	Tan
CEC-25-03	82	0.1	mg/cm2	Negative	1	3/19/2025	13:22:31	nazeer	Action Level	Lead Paint	Ceiling	Concrete	Appliance Store Base - Front Storage	Poor	Green
CEC-25-03	83	11.3	mg/cm2	Positive	1	3/19/2025	13:24:19	nazeer	Action Level	Lead Paint	Wall D	Plaster	Appliance Store Base - Main Area	Poor	Green
CEC-25-03	84	16.7	mg/cm2	Positive	1	3/19/2025	13:24:40	nazeer	Action Level	Lead Paint	Colum	Concrete	Appliance Store Base - Main Area	Poor	Green
CEC-25-03	85	0.6	mg/cm2	Negative	1	3/19/2025	13:26:20	nazeer	Action Level	Lead Paint	Ceiling	Concrete	Appliance Store Base - Main Area	Poor	Green
CEC-25-03	86	0.5	mg/cm2	Negative	1	3/19/2025	13:27:34	nazeer	Action Level	Lead Paint	Ceiling Beam	Concrete	Appliance Store Base - Main Area	Poor	Green
CEC-25-03	87	0	mg/cm2	Negative	1	3/19/2025	13:28:41	nazeer	Action Level	Lead Paint	Wall C	Plaster	Appliance Store Base - Main Area	Poor	Green
CEC-25-03	88	0.1	mg/cm2	Negative	1	3/19/2025	13:29:39	nazeer	Action Level	Lead Paint	2" Pipe	Metal	Appliance Store Base - Main Area	Good	White
CEC-25-03	89	0.1	mg/cm2	Negative	1	3/19/2025	13:43:25	nazeer	Action Level	Lead Paint	Electric Panel	Wood	Appliance Store Base - Electric Room	Good	Black
CEC-25-03	90	0.3	mg/cm2	Negative	1	3/19/2025	14:24:22	nazeer	Action Level	Lead Paint	Wall A	Plaster	Police Department - Basement Office	Good	Tan
CEC-25-03	91	0.6	mg/cm2	Negative	1	3/19/2025	14:25:17	nazeer	Action Level	Lead Paint	Wall B	Stucco	Police Department - Basement Office	Good	Orange
CEC-25-03	92	0.2	mg/cm2	Negative	1	3/19/2025	14:26:15	nazeer	Action Level	Lead Paint	Window Casing	Wood	Police Department - Basement Office	Good	White
CEC-25-03	93	0.2	mg/cm2	Negative	1	3/19/2025	14:27:25	nazeer	Action Level	Lead Paint	Window Sill	Wood	Police Department - Basement Office	Good	White
CEC-25-03	94	0.3	mg/cm2	Negative	1	3/19/2025	14:27:42	nazeer	Action Level	Lead Paint	Window Apron	Wood	Police Department - Basement Office	Good	White
CEC-25-03	95	0	mg/cm2	Negative	1	3/19/2025	14:28:28	nazeer	Action Level	Lead Paint	Closet Casing	Wood	Police Department - Basement Office	Good	Stain
CEC-25-03	96	0	mg/cm2	Negative	1	3/19/2025	14:29:06	nazeer	Action Level	Lead Paint	Closet Wall	Concrete	Police Department - Basement Office	Good	Tan
CEC-25-03	97	7.7	mg/cm2	Positive	1	3/19/2025	14:30:11	nazeer	Action Level	Lead Paint	Floor	Concrete	Police Department - Basement Office	Poor	Red
CEC-25-03	98	3.4	mg/cm2	Positive	1	3/19/2025	14:31:44	nazeer	Action Level	Lead Paint	Ceiling	Plaster	Police Department - Basement Office	Good	White
CEC-25-03	99	4.3	mg/cm2	Positive	1	3/19/2025	14:32:08	nazeer	Action Level	Lead Paint	Ceiling Beam	Plaster	Police Department - Basement Office	Good	White
CEC-25-03	100	0	mg/cm2	Negative	1	3/19/2025	14:32:29	nazeer	Action Level	Lead Paint	3" Pipe	Metal	Police Department - Basement Office	Good	White
CEC-25-03	101	7.7	mg/cm2	Positive	1	3/19/2025	14:34:41	nazeer	Action Level	Lead Paint	Wall A	Concrete	Police Dept - Basement Storage Cell	Good	White
CEC-25-03	102	5.5	mg/cm2	Positive	1	3/19/2025	14:34:59	nazeer	Action Level	Lead Paint	Wall B	Concrete	Police Dept - Basement Storage Cell	Good	White
CEC-25-03	103	5.8	mg/cm2	Positive	1	3/19/2025	14:35:21	nazeer	Action Level	Lead Paint	Wall D	Concrete	Police Dept - Basement Storage Cell	Good	White
CEC-25-03	104	1.7	mg/cm2	Positive	1	3/19/2025	14:37:10	nazeer	Action Level	Lead Paint	3" Pipe	Metal	Police Dept - Basement Storage Cell	Good	Silver
CEC-25-03	105	0.1	mg/cm2	Negative	1	3/19/2025	14:38:16	nazeer	Action Level	Lead Paint	Door	Metal	Police Dept - Basement Storage Cell	Good	Silver
CEC-25-03	106	0.2	mg/cm2	Negative	1	3/19/2025	14:38:38	nazeer	Action Level	Lead Paint	Ceiling	Metal	Police Dept - Basement Storage Cell	Good	Blue
CEC-25-03	107	6.9	mg/cm2	Positive	1	3/19/2025	14:42:44	nazeer	Action Level	Lead Paint	4" Pipe	Metal	Police Dept- Basement Jail Cell Area	Good	Blue
CEC-25-03	108	1.6	mg/cm2	Positive	1	3/19/2025	14:42:58	nazeer	Action Level	Lead Paint	Window Sash	Wood	Police Dept- Basement Jail Cell Area	Good	Blue
CEC-25-03	109	9.1	mg/cm2	Positive	1	3/19/2025	14:43:23	nazeer	Action Level	Lead Paint	Window Sill	Wood	Police Dept- Basement Jail Cell Area	Good	Blue
CEC-25-03	110	7.7	mg/cm2	Positive	1	3/19/2025	14:43:42	nazeer	Action Level	Lead Paint	Window Apron	Wood	Police Dept- Basement Jail Cell Area	Good	Blue
CEC-25-03	111	2.6	mg/cm2	Positive	1	3/19/2025	14:43:55	nazeer	Action Level	Lead Paint	2" Pipe	Metal	Police Dept- Basement Jail Cell Area	Good	Blue
CEC-25-03	112	0.4	mg/cm2	Negative	1	3/19/2025	14:49:09	nazeer	Action Level	Lead Paint	Cell Door	Metal	Police Dept- Basement Jail Cell Area	Poor	Blue
CEC-25-03	113	0.1	mg/cm2	Negative	1	3/19/2025	14:49:58	nazeer	Action Level	Lead Paint	Floor	Concrete	Police Dept- Basement Jail Cell Area	Poor	Blue
CEC-25-03	114	2.3	mg/cm2	Positive	1	3/19/2025	14:50:29	nazeer	Action Level	Lead Paint	Wall B	Metal	Police Dept- Basement Jail Cell Area	Poor	Blue
CEC-25-03	115	2.8	mg/cm2	Positive	1	3/19/2025	14:50:56	nazeer	Action Level	Lead Paint	Wall D	Metal	Police Dept- Basement Jail Cell Area	Poor	Blue
CEC-25-03	116	0.1	mg/cm2	Negative	1	3/19/2025	14:51:50	nazeer	Action Level	Lead Paint	Ceiling Heater Unit	Metal	Police Dept- Basement Jail Cell Area	Good	Silver

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Job Id	Reading #	Concentration	Units	Result	Action Level	Date	Time	User	Mode	Analytic Mode	Structure	Substrate	Location	Condition	Color
CEC-25-03	117	0	mg/cm2	Negative	1	3/19/2025	14:53:19	nazeer	Action Level	Lead Paint	Wall A	Concrete	Police Dept - Entrance Area	Good	White
CEC-25-03	118	0	mg/cm2	Negative	1	3/19/2025	14:53:59	nazeer	Action Level	Lead Paint	Wall C	Concrete	Police Dept - Entrance Area	Good	White
CEC-25-03	119	0.2	mg/cm2	Negative	1	3/19/2025	14:54:30	nazeer	Action Level	Lead Paint	Stair Rail	Metal	Police Dept - Entrance Area	Poor	Gray
CEC-25-03	120	0.2	mg/cm2	Negative	1	3/19/2025	14:55:01	nazeer	Action Level	Lead Paint	Stair Riser	Metal	Police Dept - Entrance Area	Good	Gray
CEC-25-03	121	0	mg/cm2	Negative	1	3/19/2025	14:56:06	nazeer	Action Level	Lead Paint	Stair Wall A	Plaster	Police Dept - Entrance Area	Good	White
CEC-25-03	122	0	mg/cm2	Negative	1	3/19/2025	14:56:20	nazeer	Action Level	Lead Paint	Stair Wall D	Plaster	Police Dept - Entrance Area	Good	White
CEC-25-03	123	0.1	mg/cm2	Negative	1	3/19/2025	14:57:16	nazeer	Action Level	Lead Paint	Heater Unit	Metal	Police Dept - Entrance Area	Good	White
CEC-25-03	124	0.2	mg/cm2	Negative	1	3/19/2025	14:58:01	nazeer	Action Level	Lead Paint	Window Sill	Wood	Police Dept - Entrance Area	Good	Gray
CEC-25-03	125	0.1	mg/cm2	Negative	1	3/19/2025	14:58:33	nazeer	Action Level	Lead Paint	Window Apron	Wood	Police Dept - Entrance Area	Good	Gray
CEC-25-03	126	0.2	mg/cm2	Negative	1	3/19/2025	14:58:59	nazeer	Action Level	Lead Paint	Baseboard	Wood	Police Dept - Entrance Area	Good	Gray
CEC-25-03	127	0.2	mg/cm2	Negative	1	3/19/2025	14:59:41	nazeer	Action Level	Lead Paint	Ceiling	Concrete	Police Dept - Entrance Area	Good	White
CEC-25-03	128	0.1	mg/cm2	Negative	1	3/19/2025	15:01:14	nazeer	Action Level	Lead Paint	lentel	Metal	Police Dept - Entrance Area	Poor	White
CEC-25-03	129	1.1	mg/cm2	Positive	1	3/19/2025	15:02:27	nazeer	Action Level	Lead Paint	Calibration				
CEC-25-03	130	0.8	mg/cm2	Negative	1	3/19/2025	15:02:42	nazeer	Action Level	Lead Paint	Calibration				
CEC-25-03	131	0.8	mg/cm2	Negative	1	3/19/2025	15:03:02	nazeer	Action Level	Lead Paint	Calibration				

APPENDIX B

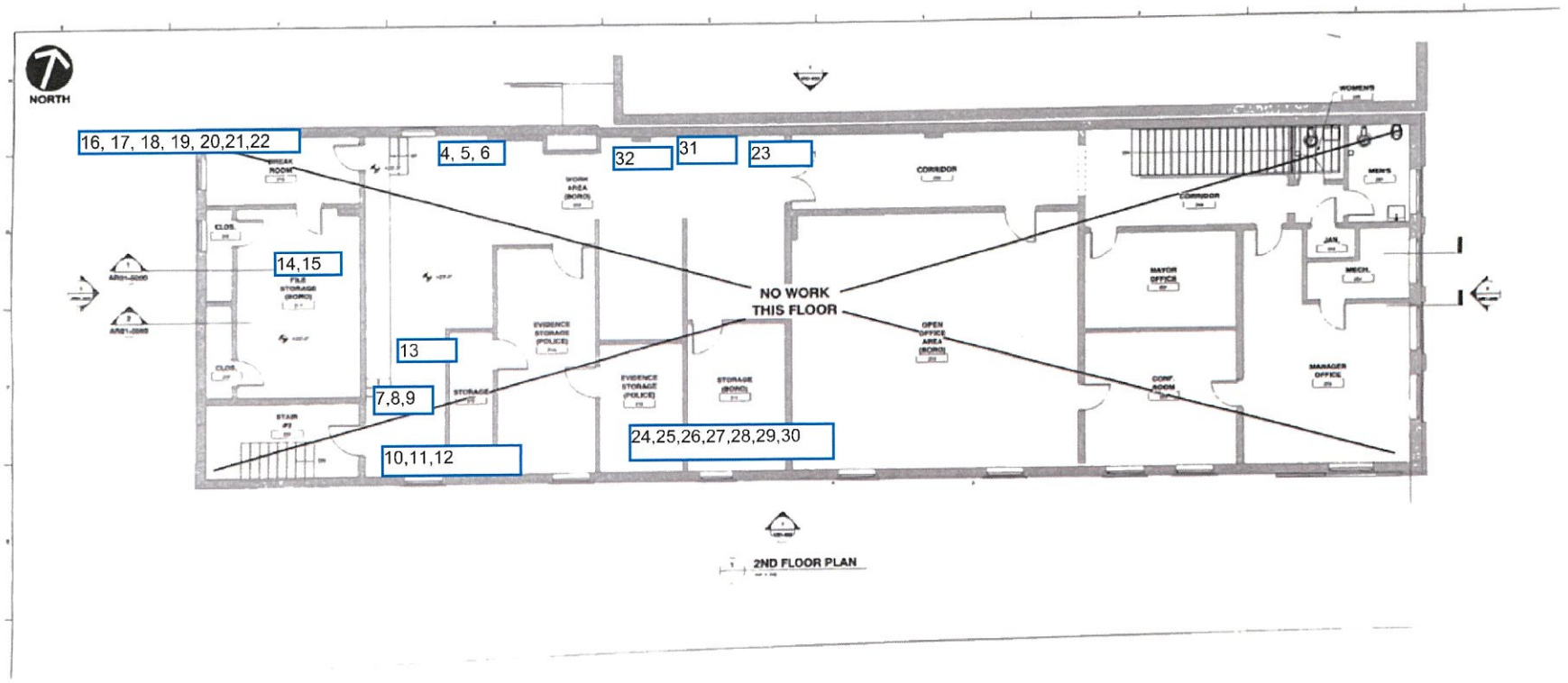
XRF Sample Location Diagrams

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424 Main Street, Irwin, PA

2nd Floor

Approximate XRF Lead Sample Locations

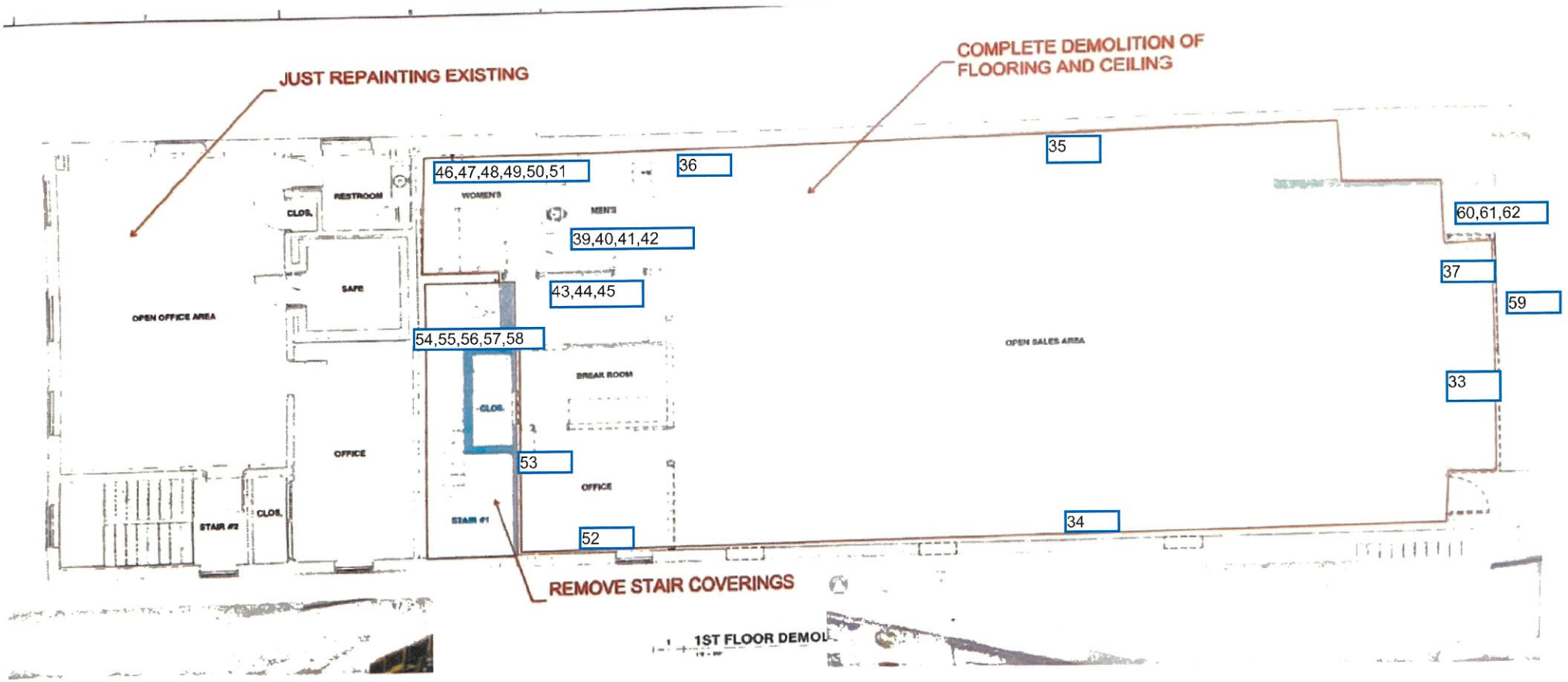


3-19-25

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Appliance Store - 1st Floor

Approximate XRF Lead Sample Locations

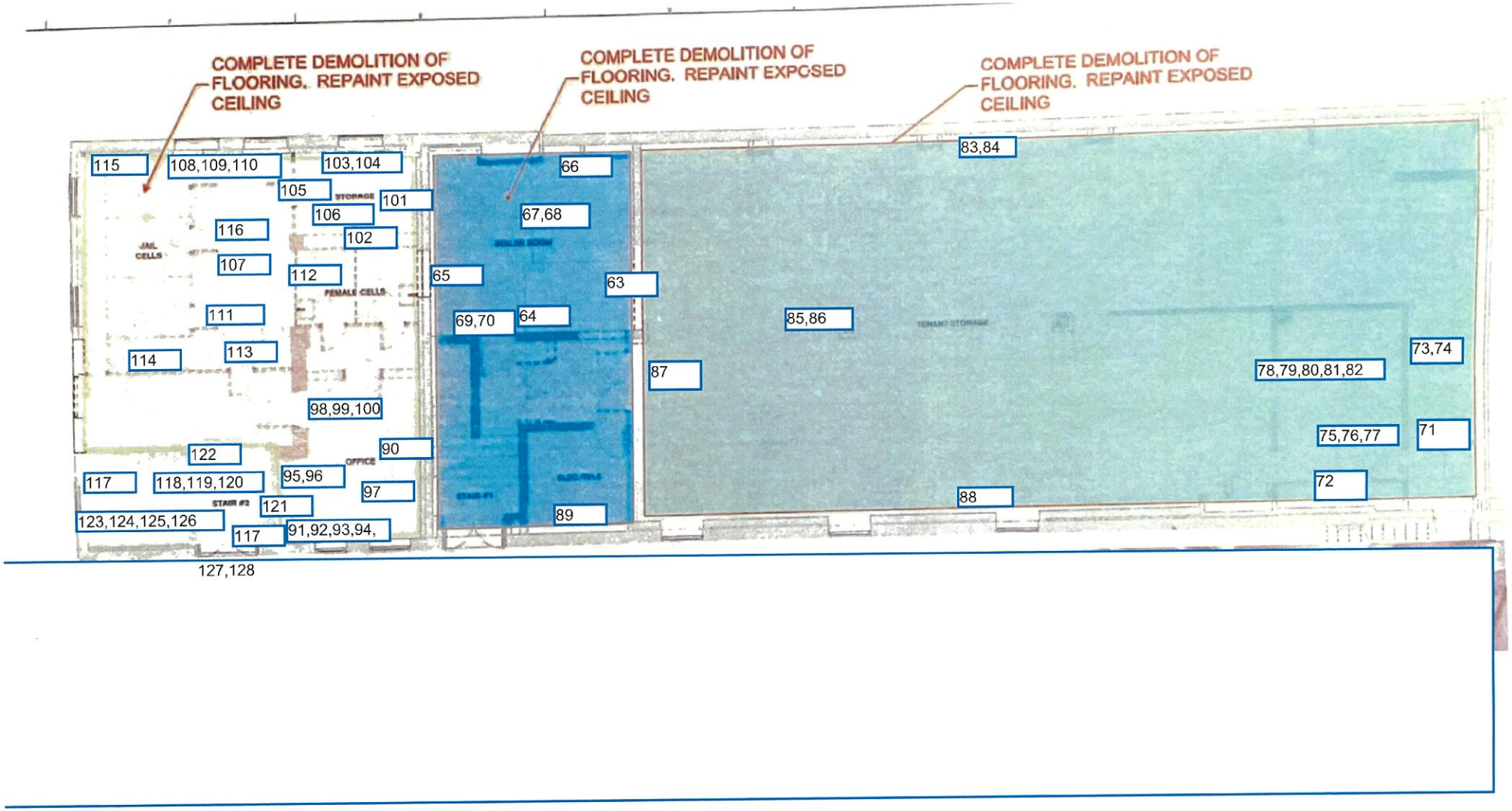


3-19-25

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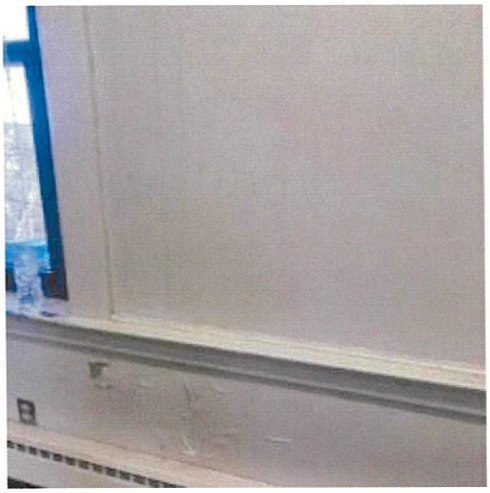
Basement Level and Police Department Basement

Approximate XRF Lead Sample Locations

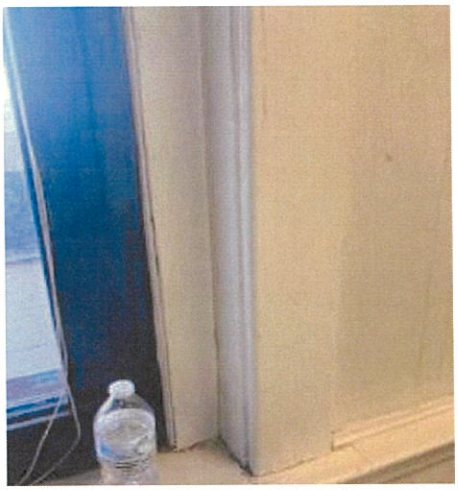


APPENDIX C

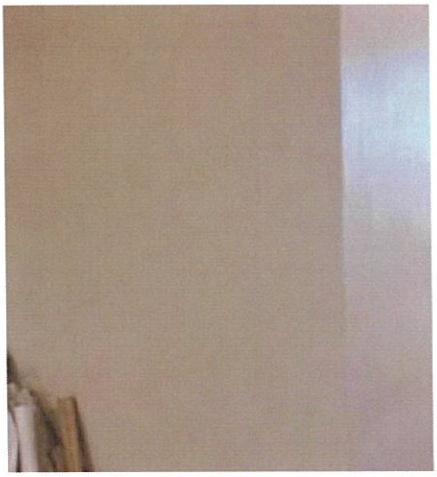
XRF Sample Photo Log



XRF 4- 2nd Floor Work Area - Wall D



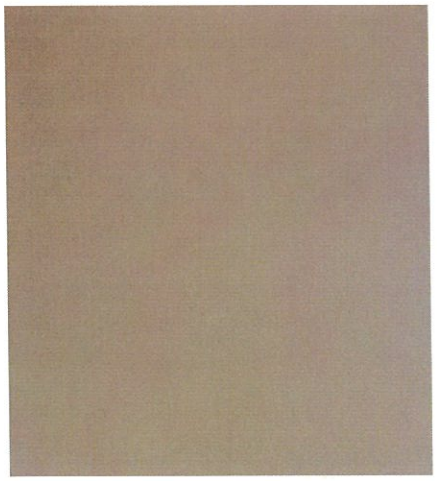
XRF 5,6 - 2nd Floor Work Area - D Window Casing / Chair Rail



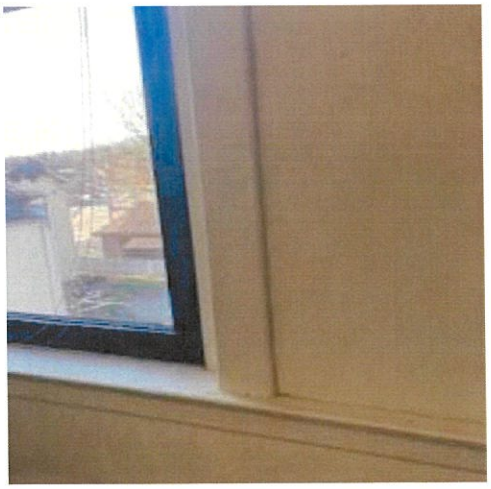
XRF 7 - 2nd Floor Work Area - Wall C



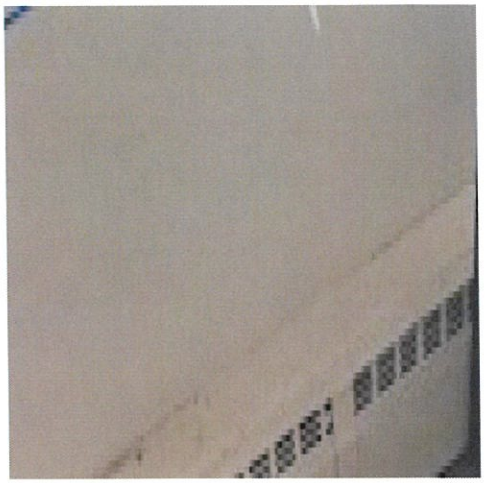
XRF 8,9 - 2nd Floor Work Area - Door and Casing



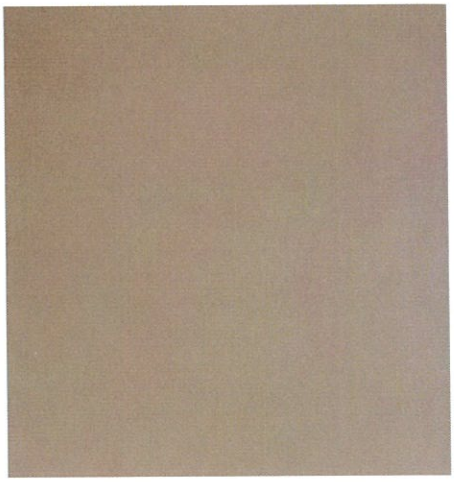
XRF 10 - 2nd Floor Work Area - Wall B



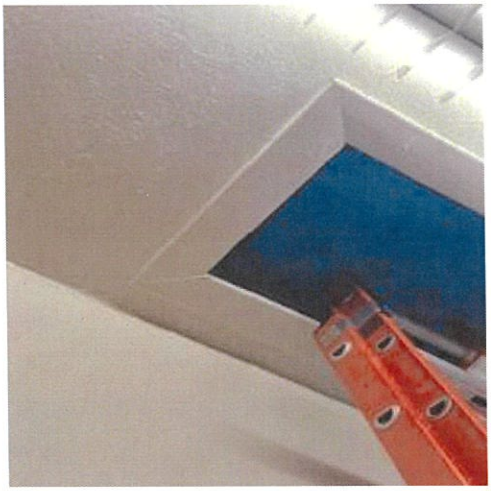
XRF 11,12 - 2nd Floor Work Area - Wall B Casing / Chair Rail



XRF 13 - 2nd Floor Work Area - Heater Unit



XRF 14 - 2nd Floor File Storage Area - Ceiling



XRF 15 - 2nd Floor File Storage Area - Access Door Frame



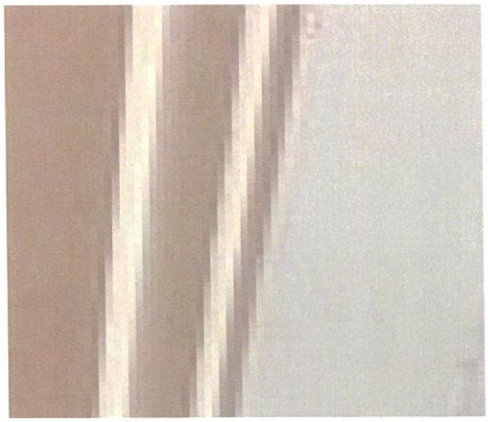
XRF 16, 17 2nd Floor File Storage Area - Wall A / Wall B



XRF 18 - 2nd Floor File Storage Area - Wall C



XRF 19 - 2nd Floor File Storage Area - Wall D



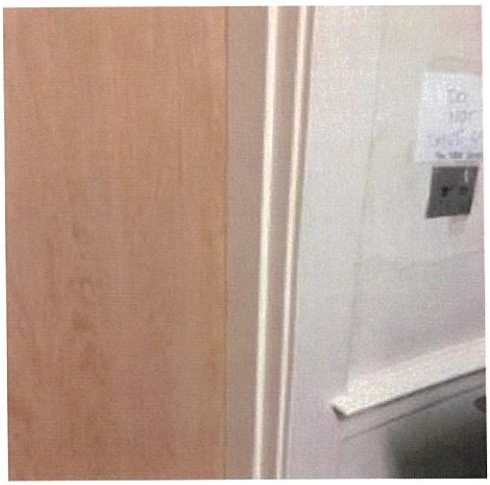
XRF 20 - 2nd Floor File Storage Area - Door Casing



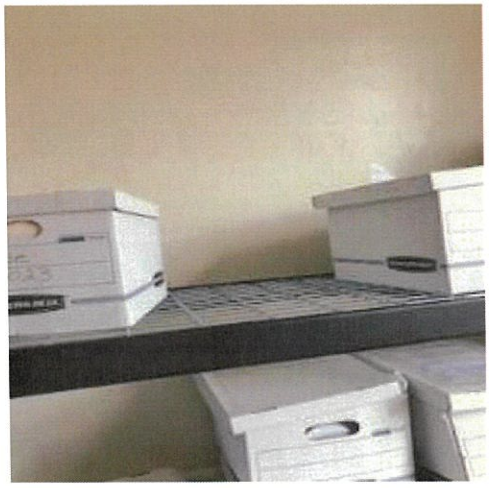
XRF 21 - 2nd Floor File Storage Area - Window Casing



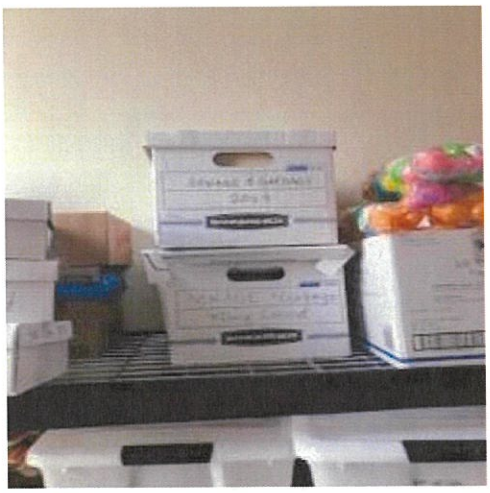
XRF 22 - 2nd Floor File Storage Area - Book Shelf



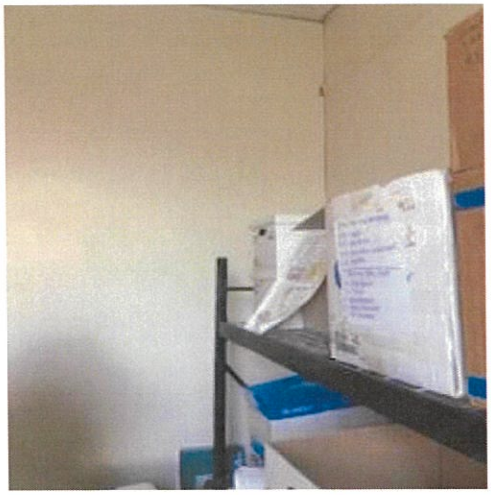
XRF 23 - 2nd Floor Work Area - Door Casing A



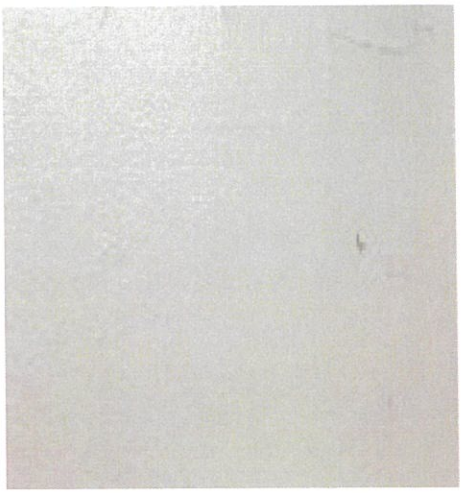
XRF 24 - 2nd Floor Front Storage - Wall A



XRF 25 - 2nd Floor Front Storage - Wall B



XRF 26 - 2nd Floor File Storage Area - Wall C



XRF 27 - 2nd Floor File Storage Area - Wall D



XRF 28, 29 - 2nd Floor File Storage Area - Window Casing / Chair Rail



XRF 30 - 2nd Floor File Storage Area - Heater Unit



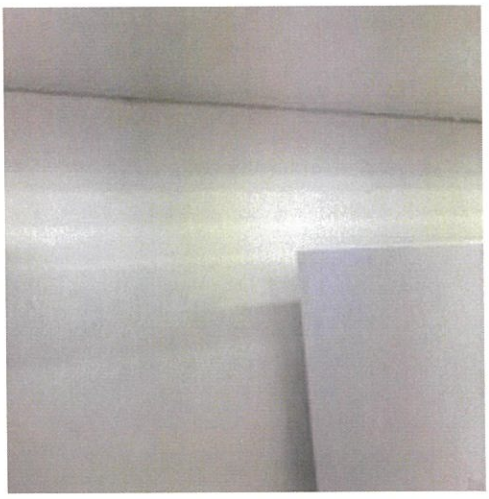
XRF 31 - 2nd Floor Work Area - Drain Pipe



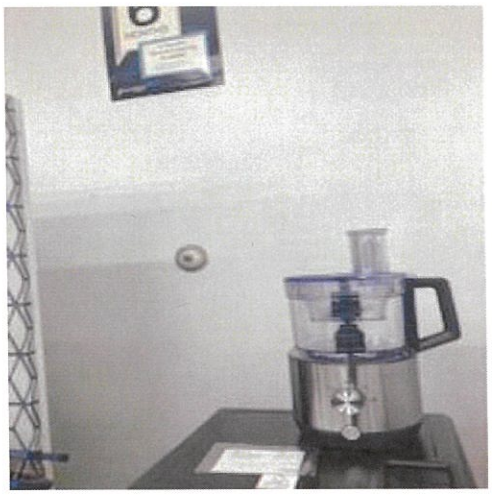
XRF 32 - 2nd Floor Work Area - Upper Wall Trim



XRF 33 - Appliance Store - Display Area Ceiling



XRF 34 - Appliance Store - Wall B



XRF 35 - Appliance Store - Wall D (Drywall Section)



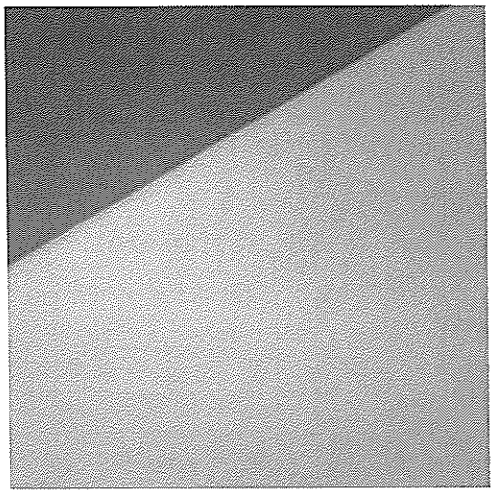
XRF 36 - Appliance Store - Wall D (Plaster Section)



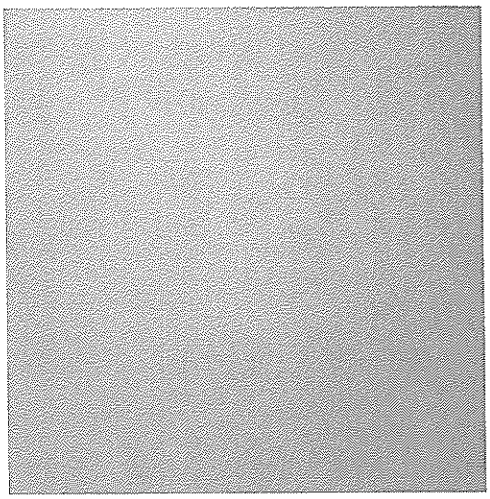
XRF 37 - Appliance Store - Blue wood Trim



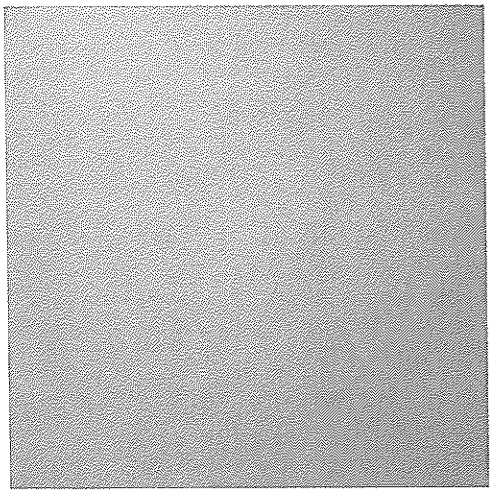
XRF 38 - Appliance Store - Men's Room - Wall D



XRF 39 - Appliance Store - Men's Room - Wall A



XRF 40 - Appliance Store - Men's Room - Wall C

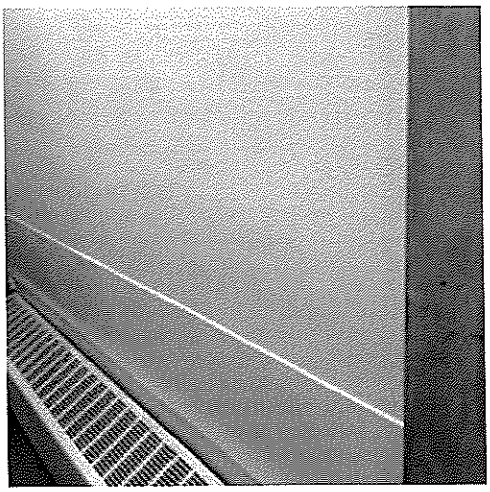


XRF 41 - Appliance Store - Men's Room - Wall B



XRF 42 - Appliance Store - Men's Room - Closet Casing

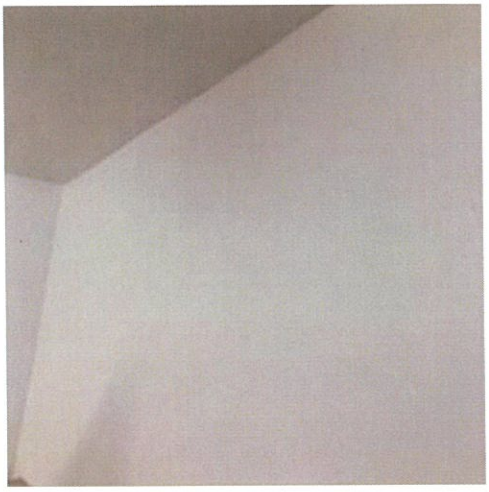




XRF 43 - Appliance Store Hall - Ceiling



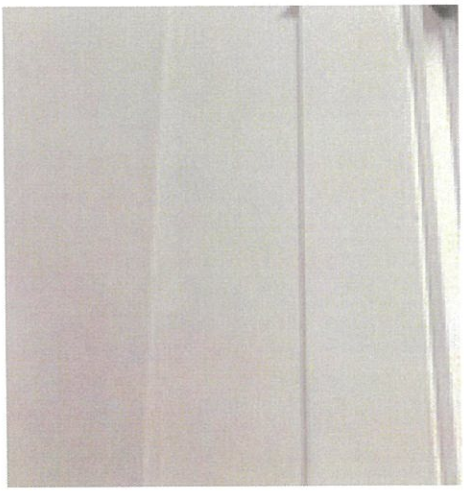
XRF 44, 45 - Appliance Store Hall - Wall B / Heater Unit



XRF 46 - Appliance Store Women's Room - Wall D

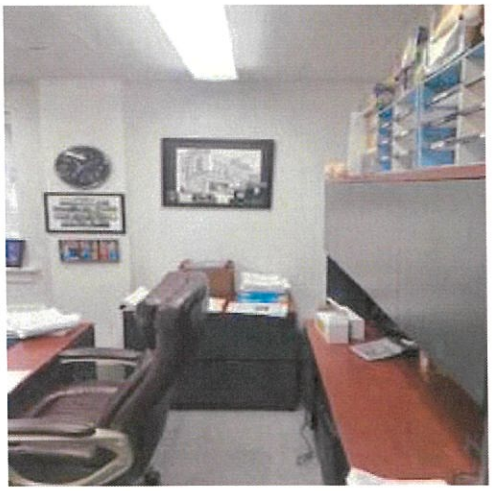


XRF 47 - Appliance Store Women's Room - Wall A



XRF 48, 49, 50 - Appliance Store Women's Room - Wall B / Wall C / Ceiling

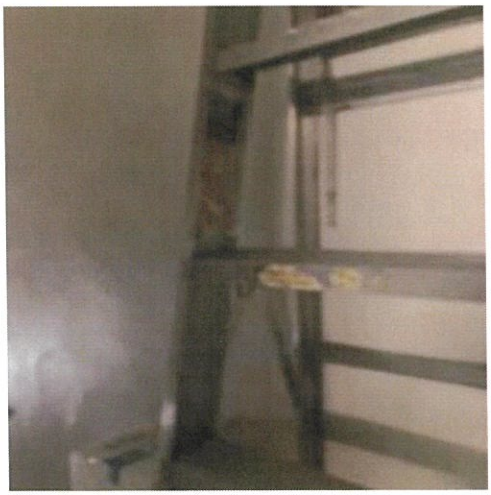
XRF 51 - Appliance Store Women's Room - Door Casing



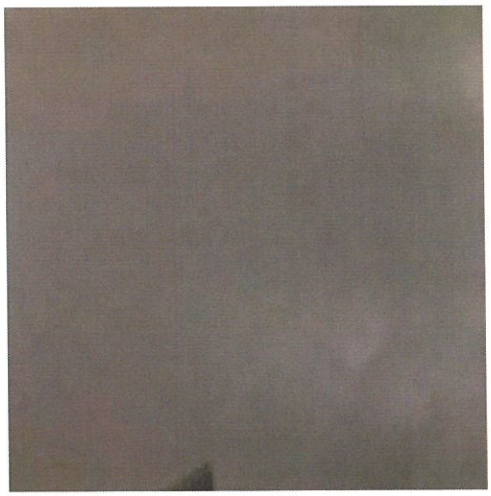
XRF 52 - Appliance Store Office - Wall B



XRF 53 - Appliance Store Office - Wall C



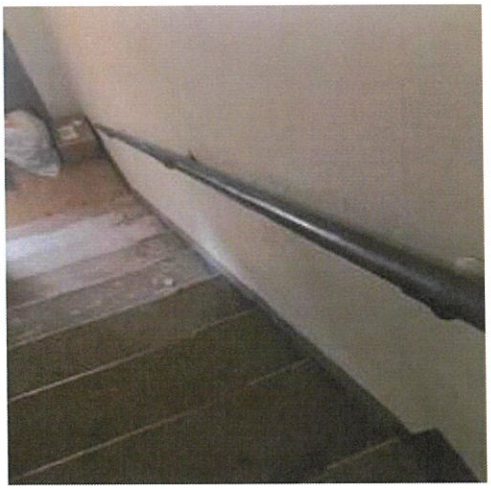
XRF 54 - Appliance Store Rear Stairs - Wall A



XRF 55 - Appliance Store Rear Stairs - Wall C



XRF 56 - Appliance Store Rear Stairs - Ceiling



XRF 57 - Appliance Store Rear Stairs - Stair Rail



XRF 58 - Appliance Store Rear Stairs - Stair Riser



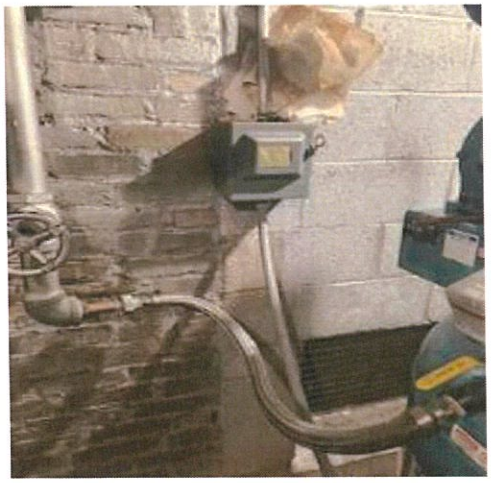
XRF 59 - Appliance Store Exterior Front - Post

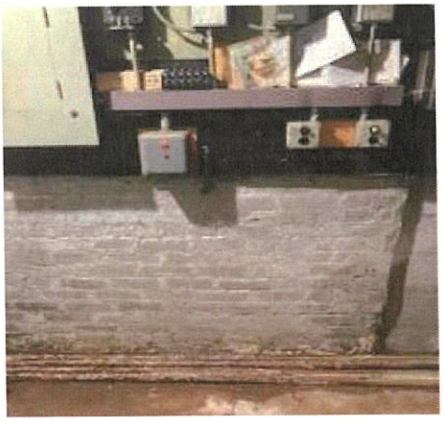


XRF 60 - Appliance Store Exterior Front - Wall A



XRF 61, 62 - Appliance Store Exterior Front - Ceiling / Wood Trim

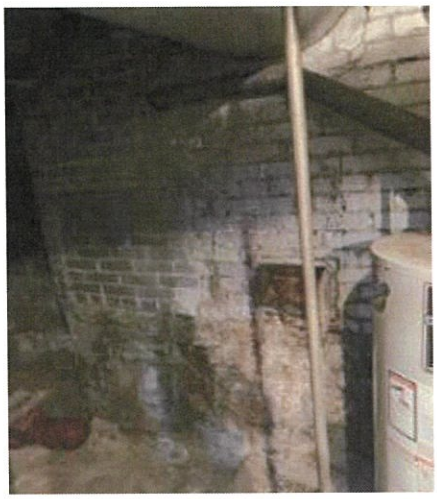




XRF 63 - Appliance Store Boiler Room - Wall A

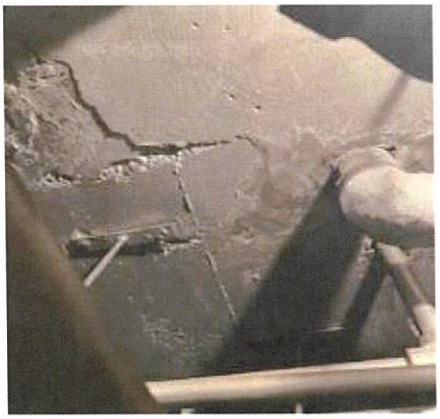


XRF 64 - Appliance Store Boiler Room - Wall B



XRF 65 - Appliance Store Boiler Room - Wall C

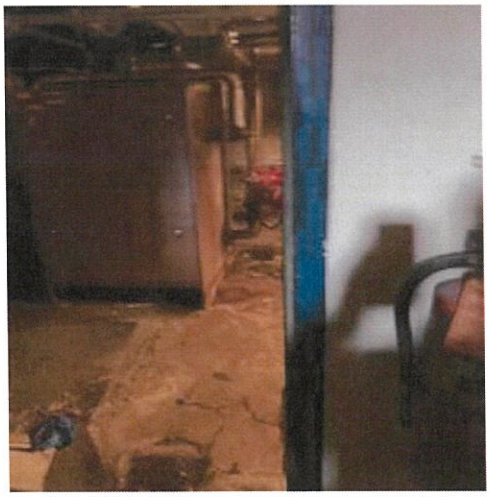
XRF 66 - Appliance Store Boiler Room - Wall D



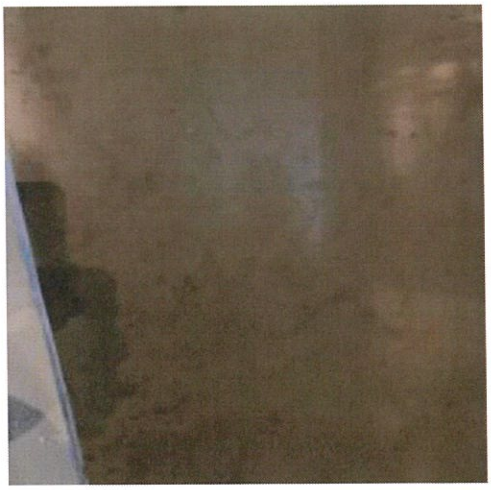
XRF 67 - Appliance Store Boiler Room - Ceiling



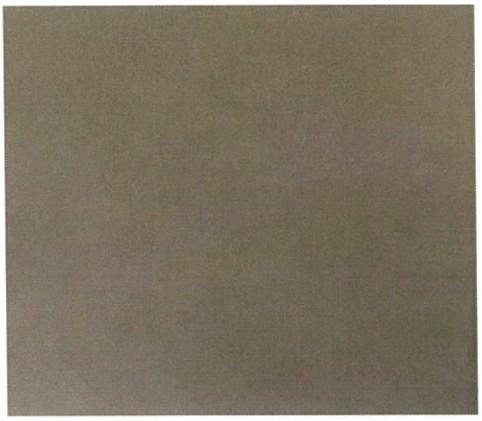
XRF 68 - Appliance Store Boiler Room - 4" Boiler Pipe



XRF 69, 70 - Appliance Store Boiler Room - Door Casing / Door Jamb



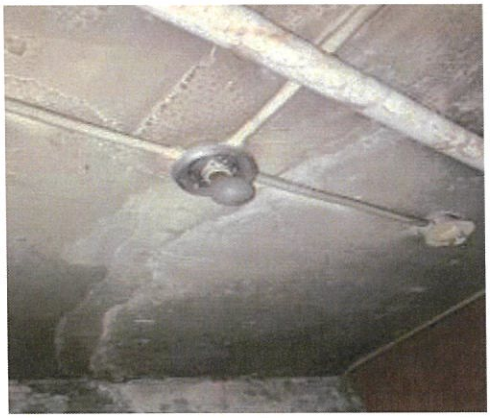
XRF 71 - Appliance Store Basement Front Room - Wall A



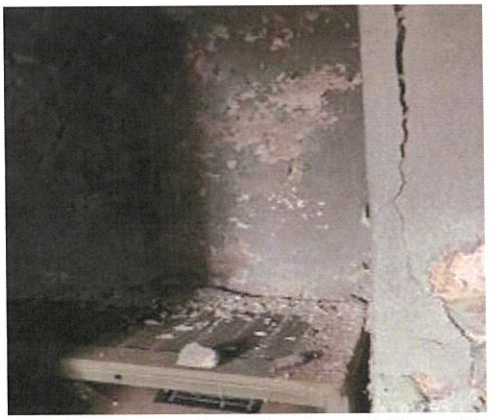
XRF 72 - Appliance Store Basement Front Room - Wall B



XRF 73 - Appliance Store Basement Front Room - Ceiling Beam



XRF 74 - Appliance Store Basement Front Room - Ceiling



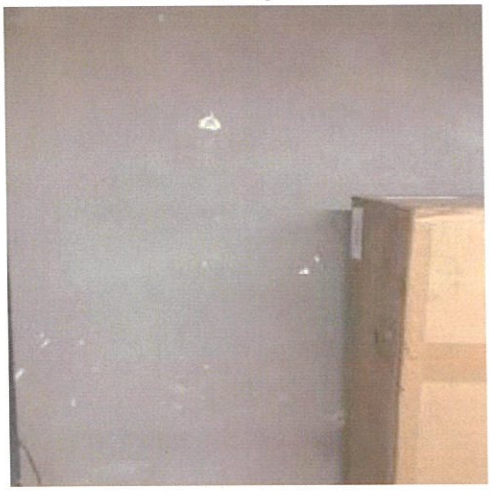
XRF 75 - Appliance Store Basement Front Room - Colum



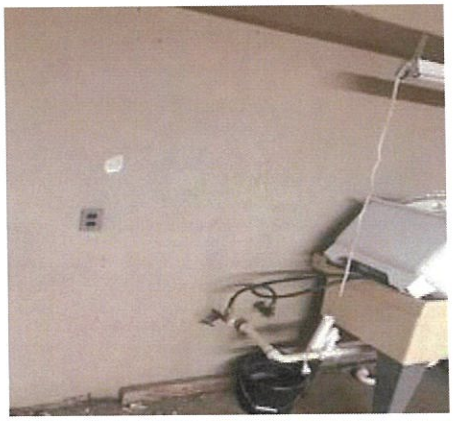
XRF 76 , 77- Appliance Store Basement Front Room - Door Casing / Door



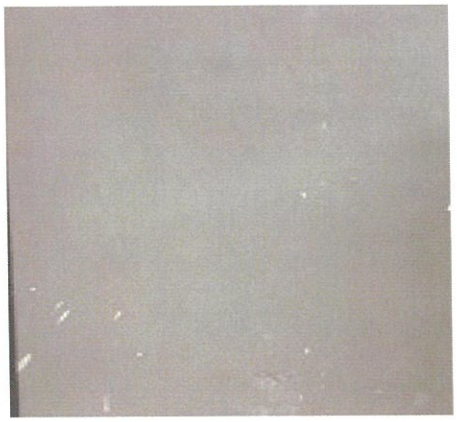
XRF 78 - Appliance Store Basement - Front Storage - Wall A



XRF 79 - Appliance Store Basement Front Storge - Wall B



XRF 80 - Appliance Store Basement Front Storage - Wall C

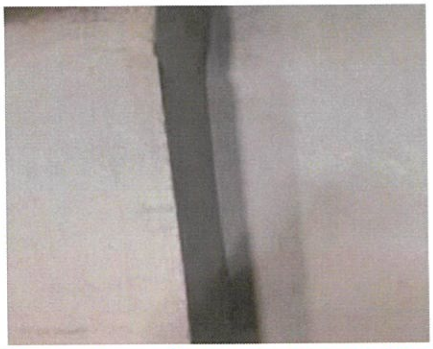




XRF 81 - Appliance Store Basement Front Room - Front Storage - Wall D

XRF 82 - Appliance Store Basement Front Room - Front Storage - Ceiling

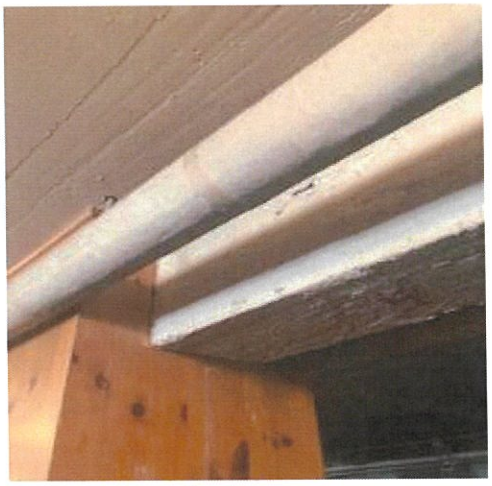




XRF 83 - Appliance Store Basement Main Area - Wall D

XRF 84 - Appliance Store Basement Main Area - Column



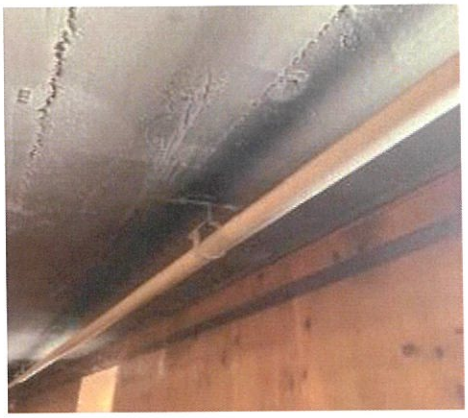


XRF 85 - Appliance Store Basement Main Area - Ceiling

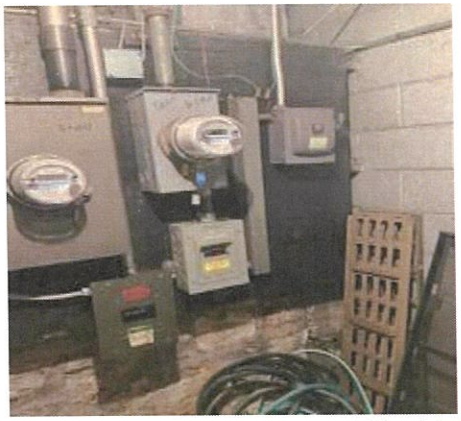
XRF 86 - Appliance Store Basement Front Room - Ceiling Beam



XRF 87 - Appliance Store Basement Main Area - Wall C



XRF 88 - Appliance Store Basement Main Area - 2" Pipe



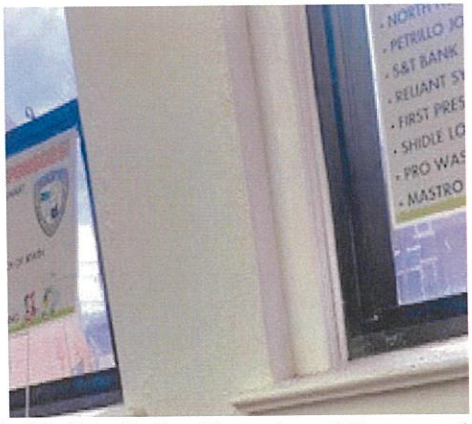
XRF 89 - Appliance Store Basement Electric Room - Electric Panel



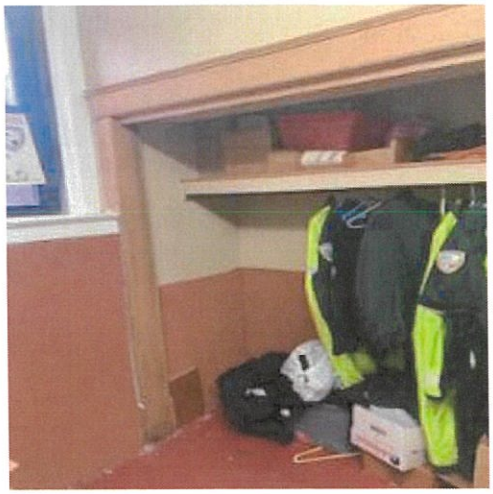
XRF 90 - Police Department Basement Office - Wall A



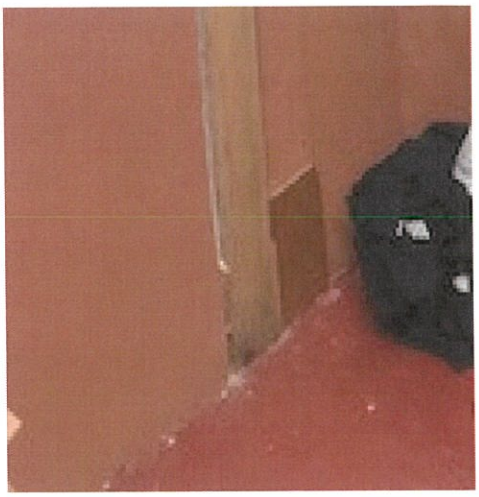
XRF 91 - Police Department Basement Office - Wall B



XRF 92, 93, 94 - Police Department Basement Office - Window Casing / Sill / Apron



XRF 95, 96 - Police Department Basement Office - Closet Casing /Wall



XRF 97 - Police Department Basement Office - Floor



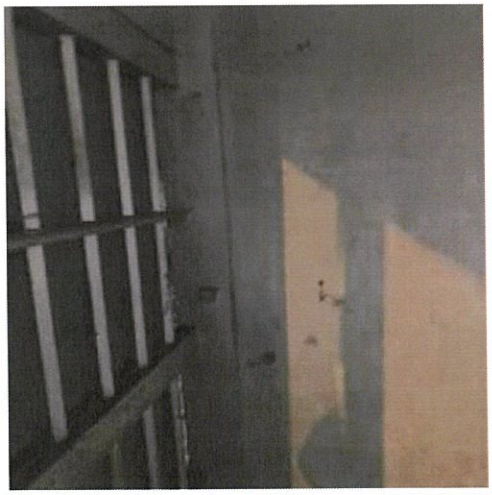
XRF 98, 99 Police Department Basement Office - Ceiling / Ceiling Beam



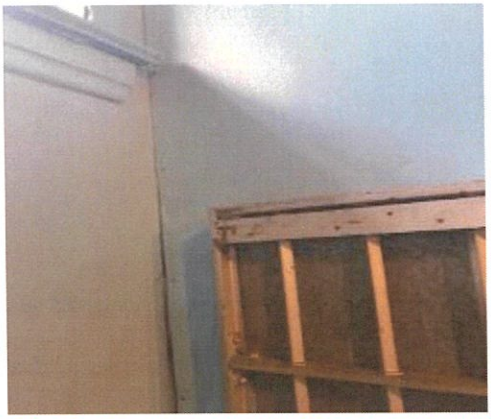
XRF 100 - Police Department Basement Office - 3" Pipe



XRF 101 - Police Department Basement Cell Storage - Wall A



XRF 102 - Police Department Basement Cell Storage - Wall B



XRF 103 - Police Department Basement Cell Storage - Wall D



XRF 104 - Police Department Basement Cell Storage - 3" Pipe



XRF 105 - Police Department Basement Cell Storage Door



XRF 106 - Police Department Basement Cell Storage - Ceiling





XRF 107 - Police Department Basement Jail Cell Area - 4" Pipe

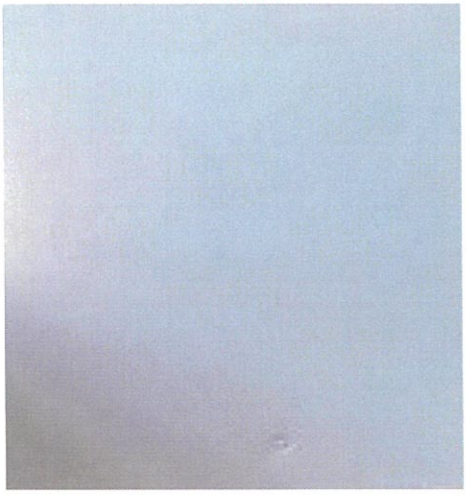
XRF 108, 109, 110 Police Department Basement Jail Cell Area - Window Sash, Sill, Apron



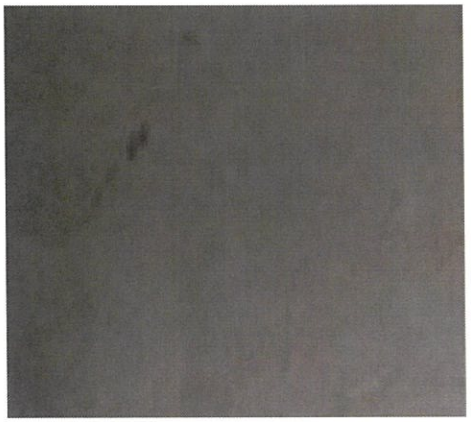
XRF 111 - Police Department Basement Jail Cell Area - 2" Pipe



XRF 112, 113 - Police Department Basement Jail Cell Area - Cell Door / Floor



XRF 114 - Police Department Basement Jail Cell Area - Wall B



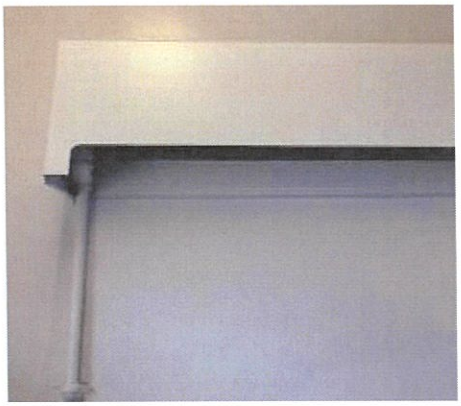
XRF 115 - Police Department Basement Jail Cell Area - Wall D



XRF 116 - Police Department Basement Jail Cell Area - Heater Unit



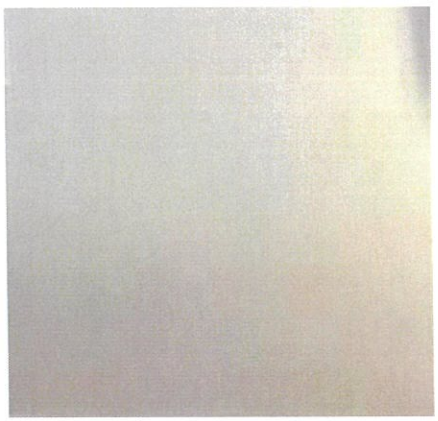
XRF 117 - Police Department Entrance Area - Wall A

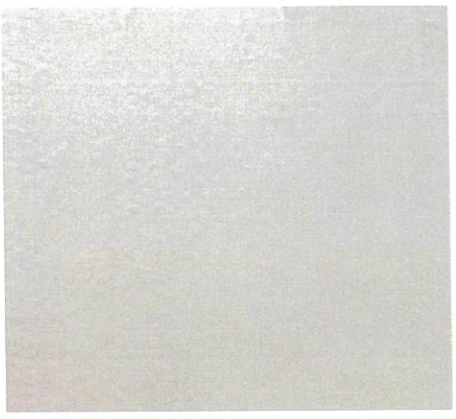


XRF 118 - Police Department Entrance Area - Wall C



XRF 119, 120 - Police Department Entrance Area - Stair Rail / Stair Riser



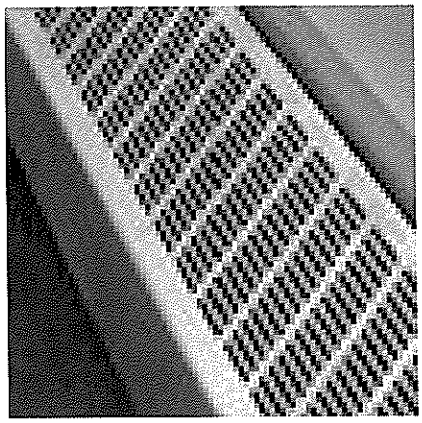


XRF 120 - Police Department Entrance Area - Stair Wall A

XRF 121 - Police Department Entrance Area - Stair Wall D



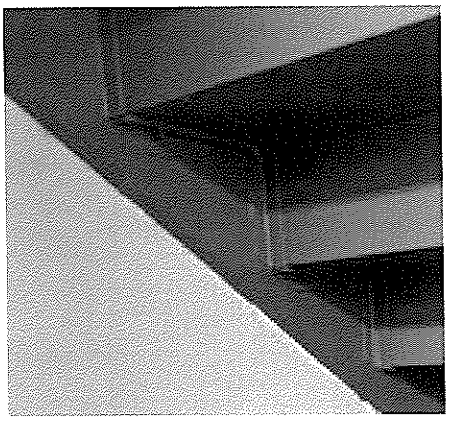
XRF 122 - Police Department Entrance Area - Stair Wall D



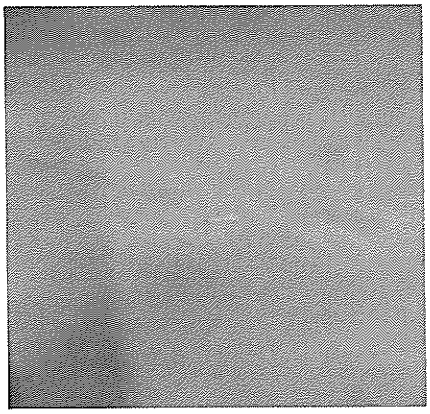
XRF 123 - Police Department Entrance Area - Heater Unit



XRF 124, 125 - Police Department Entrance Area - Window Sill / Apron



XRF 126 - Police Department Entrance Area -



XRF 127, 128 - Police Department Entrance Area - Stoop Ceiling / Lentel

APPENDIX D

XRF Performance Characteristics Sheets

Performance Characteristic Sheet

EFFECTIVE DATE: **January 1, 2022**

MANUFACTURER AND MODEL:

Make: ***Viken Detection*** (previously Heuresis)
Models: ***Model Pb200i***
Source: ***^{57}Co, 5 mCi (nominal – new source)***

FIELD OPERATION GUIDANCE

ACTION LEVEL SETTING:

0.7 mg/cm^2

OPERATING PARAMETERS:

Action Level mode, fixed 5-second reading (nominal), software version Pb 200i-5.0-DEBUG or higher.

Action Level mode, variable-time reading (2-5 seconds nominal), software version Pb 200i-7.0.0 or higher.

XRF CALIBRATION CHECK LIMITS:

0.8 to 1.2 mg/cm^2 (inclusive) at Action Level setting = 1.0 mg/cm^2

SUBSTRATE CORRECTION:

Not applicable

INCONCLUSIVE RANGE OR THRESHOLD:

ACTION LEVEL MODE READING DESCRIPTION	SUBSTRATE	INCONCLUSIVE RANGE (mg/cm^2)
Results not corrected for substrate bias on any substrate	Brick	0.6 – 0.8
	Concrete	0.6 – 0.8
	Drywall	0.6 – 0.8
	Metal	0.6 – 0.8
	Plaster	0.6 – 0.8
	Wood	0.6 – 0.8

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE:

This sheet is supplemental information to be used in conjunction with Chapter 7 of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*, 2012 Edition ("HUD Guidelines"). Performance parameters shown on this sheet are calculated using test results on building components in the HUD archive. Testing was conducted on 146 test samples in January 2020 and January 2021, with four separate instruments running software version Pb200i 5.0 (DEBUG version) in Action Level test mode. The actual source strength of the 2020 instruments on the day of testing was approximately 2.9 mCi; source ages were approximately 9 months. The 2021 instruments had new sources with strength 5 mCi.

OPERATING PARAMETERS

Performance parameters shown in this sheet are applicable only when properly operating the instrument using the manufacturer's instructions and procedures described in Chapter 7 of the HUD Guidelines.

XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked ***with the Action Level set to 1.0 mg/cm^2*** using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) used (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film; for NIST SRM 2579a, use the 1.04 mg/cm^2 film).

If the average (rounded to 1 decimal place) of three readings is outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instrument into control before XRF testing proceeds.

EVALUATING THE QUALITY OF XRF TESTING:

Randomly select ten testing combinations for retesting from each house or from two randomly selected units in multifamily housing.

Conduct XRF re-testing at the ten testing combinations selected for retesting.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below. Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. In single-family and multi-family housing, a result is defined as a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and the retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF readings.

Compute the average of all ten re-test XRF readings.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

TESTING TIMES:

The nominal reading time recorded in Archive tests averaged 5.38 seconds in fixed-time mode and 2.64 seconds in variable-time mode. Nominal reading time means the time the instrument's shutter is open when the ^{57}Co source is new. Actual reading time depends on the age of the source. Since ^{57}Co has a half-life of approximately 9 months, reading time doubles for every 9 months of source age.

CLASSIFICATION OF RESULTS:

XRF results are classified as **positive** if they are **greater than or equal** to 0.8 mg/cm^2, ***negative*** if they are ***less than or equal*** *to* 0.6 mg/cm^2 and ***inconclusive*** if they are ***equal*** to 0.7 mg/ cm^2.

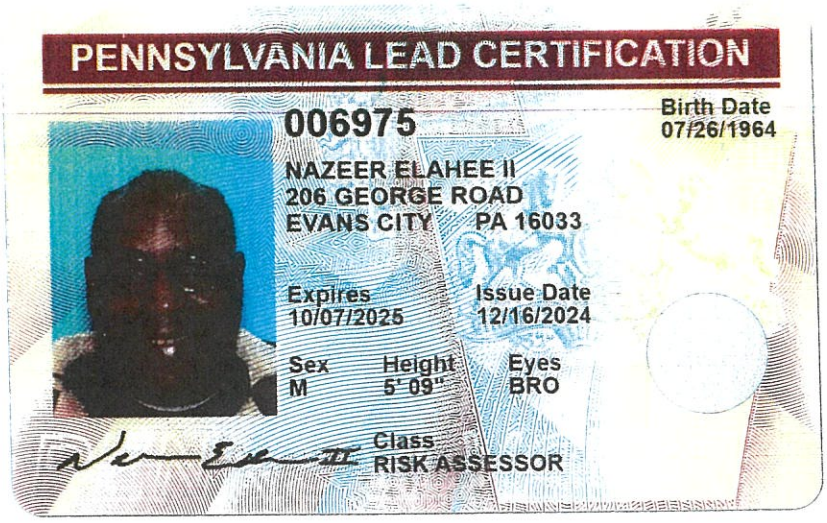
DOCUMENTATION:

This XRF Performance Characteristic Sheet (PCS) was developed by QuanTech, Inc., under a contract with the U.S. Department of Housing and Urban Development, Office of Lead Hazard Control and Healthy Homes.

A report titled *Methodology for XRF Performance Characteristic Sheets* (EPA 747-R-95-008) provides an explanation of the statistical methodology used to develop Performance Characteristic Sheets at the Federal standard (Action Level) of 1.0 mg/cm^2, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. The report may be downloaded at http://www2.epa.gov/lead/methodology-xrf-performance-characteristic-sheets-epa-747-r-95-008-september-1997. The methodology was subsequently generalized by QuanTech for application to other Action Levels.

APPENDIX E

Certifications / Licensing


PENNSYLVANIA LEAD CERTIFICATION
006975
Birth Date
07/26/1964
NAZEER ELAHEE II
206 GEORGE ROAD
EVANS CITY PA 16033
Expires
10/07/2025
Issue Date
12/16/2024
Sex
M
Height
5' 09"
Eyes
BRO
Class
RISK ASSESSOR

GST

This is to certify that

NAZEER ELAHEE II

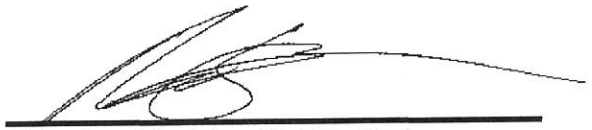
has successfully completed the 8 hours

LEAD RISK ASSESSOR REFRESHER

(VIRTUAL)

In accordance with 40 CFR 745 with a minimum passing score of 70%
GST Company has received approval as a training provider for Lead Based Paint from the Pennsylvania, Department of Labor and Industry.

Certificate No.:	**1216-ST**
Training Course Date(s):	**OCTOBER 7, 2024**
Examination Date:	**OCTOBER 7, 2024**
Expiration Date:	**OCTOBER 7, 2027**



Director of Training, Nick Stanford
GST Company
357 Northgate Drive, STE 3
Warrendale, PA 15086
724-831-9724

Mid-Atlantic Environmental Consultants

IRWIN BOROUGH BUILDING
424 MAIN STREET
IRWIN, PENNSYLVANIA
(WESTMORELAND COUNTY)



LIMITED ASBESTOS RENOVATION SURVEY

MID ATLANTIC JOB NUMBER: CEC-25-03

MARCH 2025

PREPARED FOR:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
700 CHERRINGTON PARKWAY
MOON TOWNSHIP, PA 15108

PREPARED BY:

MID ATLANTIC ENVIRONMENTAL CONSULTANTS, INC.
5320 N. PIONEER ROAD
GIBSONIA, PA 15044
(724) 444-3460 – OFFICE
(724) 444-3463 – FAX
midatlantic@zoominternet.net – EMAIL

Mid-Atlantic Environmental Consultants

5320 North Pioneer Road
Gibsonia, PA 15044
Phone: 724-444-3460
Fax: 724-444-3463
Email: midatlantic@zoominternet.net

March 28th, 2025

Civil & Environmental Consultants, Inc.
700 Cherrington Parkway
Moon Township, Pa 15108

Attn: Mr. Scott Maritzer

Re: Limited Asbestos Renovation Survey

To Whom It May Concern:

On Wednesday March 19th, 2025, Mid Atlantic Environmental Consultants, Inc. mobilized and implemented a Limited Asbestos Renovation Survey of the Irwin Borough Building located at 424 Main St. in Irwin, Pennsylvania (Westmoreland County). Survey work was implemented in designated areas only. The purpose of this asbestos survey was to identify any visible and/or accessible suspect asbestos containing building materials that may impact planned future renovations to the subject building. All visible and accessible suspect asbestos containing materials were retrieved and analyzed by Polarized Light Microscopy (PLM) with dispersion staining techniques. An asbestos inspection report indicating the results of the bulk sampling is enclosed. Mr. Edgar King, an EPA accredited asbestos inspector certified by the State of Pennsylvania, conducted all survey work. This survey and report are for informational purposes only and are based on the best available information at the time of the asbestos survey. The information is intended to provide a basis to solicit bids and develop a plan for abatement work if required. Asbestos containing materials may be present which were not able to be identified during this asbestos survey. If inaccessible areas are exposed during future renovation or demolition procedures, additional asbestos containing materials may be discovered. A change in the scope of services to identify and categorize the undiscovered asbestos containing building materials may be required.

Mid Atlantic Environmental Consultants, Inc. appreciates the opportunity to assist Civil & Environmental Consultants, Inc. with this project and look forward to assisting you on future assignments. Should you have any further questions or concerns, please do not hesitate to contact us by phone at: (724) 444-3460 or by email at: midatlantic@zoominternet.net.

Sincerely,

Edgar J. King
Asbestos Building Inspector
EPA / Penna. Lic. #: 030716

Timothy E. Daniels
Asbestos Project Designer
EPA / Penna. Lic. #: 010698

IRWIN BOROUGH BUILDING – 424 MAIN ST., IRWIN, PA

Mid Atlantic Environmental Consultants, Inc. was retained by Civil & Environmental Consultants, Inc. to conduct a Limited Asbestos Renovation Survey of the Irwin Borough Building located at 424 Main St. in Irwin, Pennsylvania (Westmoreland County). On Wednesday March 19th, 2025, Mid Atlantic representative Mr. Edgar King performed a visual inspection and bulk sampling of suspect asbestos containing building materials throughout the interior and exterior of the building (excluding the rooftops). Mr. King is an EPA accredited asbestos building inspector certified by the State of Pennsylvania: License #030716. Mr. King was assisted during this survey by MAEC representative, Mr. Mark Ramela.

During Mid Atlantic's onsite investigation, the building was occupied and in fair condition. Mid Atlantics survey team performed bulk sampling of suspect asbestos containing building & thermal insulation materials throughout the designated areas as directed within the scope of work. Sampling was conducted throughout the basement, 1st floor, and limited areas within the 2nd floor. Roofing components were excluded from this survey. If future roofing and/or roofing components are to be disturbed in any manner, it is recommended that asbestos bulk sampling and associated laboratory analysis be implemented prior to any planned disturbance. Based on the age of the subject building, it is assumed that the current existing roofing materials are asbestos containing.

A total of eighty-six (86) samples (148 including splits) were collected during this asbestos survey. Of those samples, forty-one (41) were identified as being asbestos containing. An asbestos containing material is defined as any material containing greater than one percent (>1%) asbestos. For a summary of all identified asbestos containing materials, refer to Table 1 (Asbestos Containing Materials). The complete listing of materials sampled is indicated in Appendix A (Building Inspection Results).

TABLE 1: ASBESTOS CONTAINING MATERIALS

MATERIAL	LOCATION	APPROX. QUANTITY	FRIABLE / NON-FRIABLE	ASBESTOS CONTENT
Gray 9X9 Floor Tile	2nd Floor – Stage Entry – Kitchen	125 Sq Ft	Non-Friable	2 % Chrysotile
Green/Yellow/Gray 9X9 Floor Tile	2nd Floor – Rear Area – Throughout	1,400 Sq Ft	Non-Friable	2 % Chrysotile
Black Mastic	2nd Floor – Rear Stairwell – Landings (Under 12X12 Floor Tile)	170 Sq Ft	Non-Friable	2 % Chrysotile
Gray/Green/Black Layered Floor Tile	1st Floor Showroom Throughout – Some Under Carpet	2,500 Sq Ft	Non-Friable	2 % Chrysotile
Gray 9X9 Floor Tile	1st Floor – Men's Rest Room	80 Sq Ft	Non-Friable	2 % Chrysotile
Red 9X9 Floor Tile	1st Floor – Women's Room	64 Sq Ft	Non-Friable	2 % Chrysotile
Brown 9X9 Floor Tile	1st Floor – Rear Stairwell –Landings	150 Sq Ft	Non-Friable	2 % Chrysotile
Yellow/Lime Green 9X9 Floor Tile	1st Floor – Breakroom – Closet	90 Sq Ft	Non-Friable	2 % Chrysotile
Black Floor Tile	1st Floor – Office – Under Carpet	120 Sq Ft	Non-Friable	2 % Chrysotile
Brown 9X9 Floor Tile	Throughout Basement	2,600 Sq Ft	Non-Friable	2 % Chrysotile

TABLE 1: ASBESTOS CONTAINING MATERIALS (*Continued*)

MATERIAL	LOCATION	APPROX. QUANTITY	FRIABLE / NON-FRIABLE	ASBESTOS CONTENT
Brown / White 3"- 4" TSI	Basement – Various Areas Cold Water Line	250 Ln Ft Visible	Friable	5-10 % Chrysotile
White / Brown 3"- 4" TSI (Fittings)	Basement – Various Areas Cold Water Line	30 Visible	Friable	5-30 % Chrysotile
White / Brown 2"- 3" TSI	Basement – Various Areas Hot Water Line	300 Ln Ft Visible	Friable	2-10 % Chrysotile
White / Brown 2"- 3" TSI (Fittings)	Basement – Various Areas Hot Water Line	42 Visible	Friable	10-60 % Chrysotile
Silver / White Insulation	Boiler Room – Flue	82 Sq Ft	Friable	90 % Chrysotile
Gray Breeching	Boiler Room – Between Plates	120 Sq Ft	Friable	2 % Chrysotile

AmeriSci Laboratories of Midlothian, Virginia analyzed the bulk samples by Polarized Light Microscopy (PLM) methods. PLM analysis utilizes dispersion staining techniques as described by the Environmental Protection Agency (EPA) Method 600/M4-82-020.

Our recommendation for materials that are identified as regulated ACM is for the materials to be abated prior to any renovation activities being implemented, and to be performed in accordance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) regulations. This response is also guided by the facts that in the event of any demolition/renovation it is likely that the ACM will be disturbed in a manner that will potentially cause fiber release episodes thereby posing a health concern.

Any proposed future asbestos abatement work should be conducted by a licensed asbestos abatement contractor prior to implementing any demolition/renovation activity procedures. Prior to the initiation of any asbestos abatement work, ensure that all of the delegated state and local pollution control agencies in the area and / or the EPA regional office are notified.

Refer to attachments for further information:

- Appendix A – Building Inspection Results
- Appendix B – Sample Location Diagram(s)
- Appendix C – PLM Laboratory Analytical Results
- Appendix D – Accreditation / Licensing

Should you have any further questions or concerns, please do not hesitate to contact us by phone at: (724) 444-3460 or by email at midatlantic@zoominternet.net.

DISCLAIMER

DATE OF ISSUE: MARCH 2025

This asbestos survey report was prepared by Mid Atlantic Environmental Consultants, Inc. The purpose of this survey was to provide general information regarding the Irwin Borough Building located at 424 Main St. in Irwin, Pennsylvania (Westmoreland County), regarding the presence of accessible and/or exposed building materials that commonly contain asbestos. There is the distinct possibility that conditions exist which could not be identified within the scope of the study, or which were not apparent during the site visit. Roofing components were excluded from this asbestos survey. Unexposed and/or physically inaccessible areas are not warranted in regard to this specific asbestos survey. No warranties expressed or implied are made by Mid Atlantic Environmental Consultants, Inc., or its employees, as to the use of any information, apparatus, product, or process disclosed in this report. If project bidding is to be performed in regard to potential future asbestos abatement, it is recommended that all potential abatement contractors re-quantify all given quantities provided within this report. All given quantities of building materials are approximations only. This report is provided for the sole purpose of identifying visible / accessible asbestos containing building materials as outlined herein.

APPENDIX A

BUILDING INSPECTION RESULTS

Mid Atlantic Environmental Consultants, Inc.
5320 N. Pioneer Road
Gibsonia, PA 15044
(724) 444-3460 *Phone* (724) 444-3463 *Fax*
Email: midatlantic@zoominternet.net

Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
01A	2nd Floor – Stage Entry – Kitchen	Gray 9x9 Floor Tile	125 Sq Ft (A)	Poor	High	2%
01B	2nd Floor – Stage Entry – Kitchen	Black Mastic	125 Sq Ft (A)	Poor	High	None
01C	2nd Floor – Stage Entry – Kitchen	Black Tar Paper	125 Sq Ft (A)	Poor	High	None
02A	2nd Floor – Stage Entry – Kitchen	Gray 9x9 Floor Tile	(A)	Poor	High	2%
02B	2nd Floor – Stage Entry – Kitchen	Black Mastic	(A)	Poor	High	None
02C	2nd Floor – Stage Entry – Kitchen	Black Tar Paper	(A)	Poor	High	None
03A	2nd Floor – Rear Area – Throughout	Green 9x9 Floor Tile	1,400 Sq Ft (B)	Poor	High	2%
03B	2nd Floor – Rear Area – Throughout	Black Mastic	1,400 Sq Ft (B)	Poor	High	None
03C	2nd Floor – Rear Area – Throughout	Black Tar Paper	1,400 Sq Ft (B)	Poor	High	None

Please be advised that the letter / symbol under the approximate quantities column denotes approximate duplicate quantities throughout this survey for that specific material.

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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
04A	2nd Floor – Rear Entry – Throughout	Yellow / Gray 9x9 Floor Tile	(B)	Poor	High	2%
04B	2nd Floor – Rear Entry – Throughout	Black Mastic	(B)	Poor	High	None
04C	2nd Floor – Rear Entry – Throughout	Black Tar Paper	(B)	Poor	High	None
05A	2nd Floor – Rear Area Perimeter Walls	Brown / Green 6" Cove Base	270 Ln Ft (C)	Poor	High	None
05B	2nd Floor – Rear Area Perimeter Walls	Yellow Adhesive	270 Ln Ft (C)	Poor	High	None
06A	2nd Floor – Rear Area Perimeter Walls	Brown / Green 6" Cove Base	(C)	Poor	High	None
06B	2nd Floor – Rear Area Perimeter Walls	Yellow Adhesive	(C)	Poor	High	None
07A	2nd Floor – Rear Area Perimeter Throughout	White Wall Plater Skim Coat	6,800 Sq Ft (D)	Poor	High	None
07B	2nd Floor – Rear Area Perimeter Throughout	Gray Wall Plaster Base Coat	6,800 Sq Ft (D)	Poor	High	*Trace*

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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
08A	2nd Floor – Rear Area Perimeter Throughout	White Wall Plater Skim Coat	(D)	Poor	High	None
08B	2nd Floor – Rear Area Perimeter Throughout	Gray Wall Plaster Base Coat	(D)	Poor	High	None
09A	2nd Floor – Rear Area Perimeter Throughout	White Wall Plater Skim Coat	(D)	Poor	High	None
09B	2nd Floor – Rear Area Perimeter Throughout	Gray Wall Plaster Base Coat	(D)	Poor	High	None
10A	2nd Floor – Rear Area – Throughout	White Ceiling Plaster Skim Coat	1,550 Sq Ft (E)	Poor	High	None
10B	2nd Floor – Rear Area – Throughout	Gray Wall Plaster Base Coat	1,550 Sq Ft (E)	Poor	High	None
11A	2nd Floor – Rear Area – Throughout	White Ceiling Plaster Skim Coat	(E)	Poor	High	None
11B	2nd Floor – Rear Area – Throughout	Gray Wall Plaster Base Coat	(E)	Poor	High	*Trace*
12A	2nd Floor – Rear Area – Throughout	White Ceiling Plaster Skim Coat	(E)	Poor	High	None
12B	2nd Floor – Rear Area – Throughout	Gray Wall Plaster Base Coat	(E)	Poor	High	*Trace*

Please be advised that the letter / symbol under the approximate quantities column denotes approximate duplicate quantities throughout this survey for that specific material.

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Email: midatlantic@zoominternet.net

Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
13A	2nd Floor – Rear Stairwell – Landings	Gray 12x12 Floor Tile	170 Sq Ft (F)	Poor	High	None
13B	2nd Floor – Rear Stairwell – Landings	Black Mastic	170 Sq Ft (F)	Poor	High	2%
14A	2nd Floor – Rear Stairwell – Stairs	Black Stair Tread	160 Sq Ft (G)	Poor	High	None
14B	2nd Floor – Rear Stairwell – Stairs	Yellow Adhesive	160 Sq Ft (G)	Poor	High	None
15	1st Floor Showroom – Throughout	White / Brown 1x1 Ceiling Tile	2,595 Sq Ft (H)	Fair	High	None
16	1st Floor Showroom – Throughout	White / Brown 1x1 Ceiling Tile	(H)	Fair	High	None
17A	1st Floor Showroom Throughout – Under Carpet	Beige Floor Tile	2,500 Sq Ft (I)	Fair	High	2%
17B	1st Floor Showroom Throughout – Under Carpet	Black Mastic	2,500 Sq Ft (I)	Fair	High	None
17C	1st Floor Showroom Throughout – Under Carpet	Green Floor Tile	2,500 Sq Ft (I)	Fair	High	2%
17D	1st Floor Showroom Throughout – Under Carpet	Black Mastic	2,500 Sq Ft (I)	Fair	High	None
17E	1st Floor Showroom Throughout – Under Carpet	Brown Fiberboard	2,500 Sq Ft (I)	Fair	High	None

Please be advised that the letter / symbol under the approximate quantities column denotes approximate duplicate quantities throughout this survey for that specific material.

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Gibsonia, PA 15044
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Email: midatlantic@zoominternet.net

Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
18A	1st Floor Showroom Throughout – Under Carpet	Yellow Carpet Adhesive	(I)	Fair	High	None
18B	1st Floor Showroom Throughout – Under Carpet	Black Floor Tile	(I)	Fair	High	2%
18C	1st Floor Showroom Throughout – Under Carpet	Beige Adhesive	(I)	Fair	High	None
19A	1st Floor – Men's Rest Room	Gray 9x9 Floor Tile	80 Sq Ft (J)	Fair	High	2%
19B	1st Floor – Men's Rest Room	Black Mastic	80 Sq Ft (J)	Fair	High	None
20A	1st Floor – Men's Rest Room	Gray 9x9 Floor Tile	(J)	Fair	High	2%
20B	1st Floor – Men's Rest Room	Black Mastic	(J)	Fair	High	None
21A	1st Floor – Women's Room	Red 9x9 Floor Tile	64 Sq Ft (K)	Fair	High	2%
21B	1st Floor – Women's Room	Black Mastic	64 Sq Ft (K)	Fair	High	None

Please be advised that the letter / symbol under the approximate quantities column denotes approximate duplicate quantities throughout this survey for that specific material.

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(724) 444-3460 *Phone* (724) 444-3463 *Fax*
Email: midatlantic@zoominternet.net

Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
22A	1st Floor – Women's Room	Red 9x9 Floor Tile	(K)	Fair	High	2%
22B	1st Floor – Women's Room	Black Mastic	(K)	Fair	High	None
23A	1st Floor – Rear Hallway	Gray 12x12 Floor Tile	84 Sq Ft (L)	Fair	High	None
23B	1st Floor – Rear Hallway	Yellow Adhesive	84 Sq Ft (L)	Fair	High	None
24A	1st Floor – Rear Hallway	Gray 12x12 Floor Tile	(L)	Fair	High	None
24B	1st Floor – Rear Hallway	Yellow Adhesive	(L)	Fair	High	None
25A	1st Floor – Rear Stairwell	Brown 9x9 Floor Tile	150 Sq Ft (M)	Fair	High	2%
25B	1st Floor – Rear Stairwell	Black Mastic	150 Sq Ft (M)	Fair	High	None
26A	1st Floor – Rear Stairwell	Brown 9x9 Floor Tile	(M)	Fair	High	2%
26B	1st Floor – Rear Stairwell	Black Mastic	(M)	Fair	High	None

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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
27A	1st Floor – Rear Stairwell	Brown Stair Tread	160 Sq Ft (N)	Fair	High	None
27B	1st Floor – Rear Stairwell	Yellow Adhesive	160 Sq Ft (N)	Fair	High	None
28A	1st Floor – Rear Stairwell	Brown Stair Tread	(N)	Fair	High	None
28B	1st Floor – Rear Stairwell	Yellow Adhesive	(N)	Fair	High	None
29A	1st Floor – Breakroom – Closet	Yellow 9x9 Floor Tile	90 Sq Ft (O)	Fair	High	2%
29B	1st Floor – Breakroom – Closet	Black Mastic	90 Sq Ft (O)	Fair	High	None
30A	1st Floor – Breakroom – Closet	Lime Green 9x9 Floor Tile	(O)	Fair	High	2%
30B	1st Floor – Breakroom – Closet	Black Mastic	(O)	Fair	High	None
31A	1st Floor – Office – Under Carpet	Black Floor Tile	120 Sq Ft (P)	Fair	High	2%
31B	1st Floor – Office – Under Carpet	Black Mastic	120 Sq Ft (P)	Fair	High	None
31C	1st Floor – Office – Under Carpet	Black / Brown Backing / Mastic	120 Sq Ft (P)	Fair	High	None

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License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
32A	1st Floor – Office – Under Carpet	Black Floor Tile	(P)	Fair	High	2%
32B	1st Floor – Office – Under Carpet	Black / Brown Backing / Mastic	(P)	Fair	High	None
33	1st Floor – Rear Hallway – Breakroom	Off-White Drywall Ceiling	156 Sq Ft (Q)	Fair	High	None
34	1st Floor – Rear Hallway – Breakroom	Light Gray Drywall Ceiling	(Q)	Fair	High	None
35A	1st Floor – Various Areas	Red 6" Cove Base	210 Ln Ft (R)	Fair	High	None
35B	1st Floor – Various Areas	Cream Adhesive	210 Ln Ft (R)	Fair	High	None
36A	1st Floor – Various Areas	Black 6" Cove Base	(R)	Fair	High	None
36B	1st Floor – Various Areas	Cream Adhesive	(R)	Fair	High	None
37A	1st Floor – Various Areas	White Wall Plaster Skim Coat	3,500 Sq Ft (S)	Fair	High	None
37B	1st Floor – Various Areas	Gray Wall Plaster Base Coat	3,500 Sq Ft (S)	Fair	High	None

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Gibsonia, PA 15044
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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
38A	1st Floor – Various Areas	White Wall Plaster Skim Coat	(S)	Fair	High	None
38B	1st Floor – Various Areas	Gray Wall Plaster Base Coat	(S)	Fair	High	None
39A	1st Floor – Various Areas	White Wall Plaster Skim Coat	(S)	Fair	High	None
39B	1st Floor – Various Areas	Gray Wall Plaster Base Coat	(S)	Fair	High	None
40A	1st Floor – Various Areas	White Wall Plaster Skim Coat	(S)	Fair	High	None
40B	1st Floor – Various Areas	Gray Wall Plaster Base Coat	(S)	Fair	High	None
41A	1st Floor – Various Areas	White Wall Plaster Skim Coat	(S)	Fair	High	None
41B	1st Floor – Various Areas	Gray Wall Plaster Base Coat	(S)	Fair	High	None
42A	1st Floor – Various Areas	White Wall Plaster Skim Coat	(S)	Fair	High	None
42B	1st Floor – Various Areas	Gray Wall Plaster Base Coat	(S)	Fair	High	None

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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
43A	1st Floor – Various Areas	White Wall Plaster Skim Coat	(S)	Fair	High	None
43B	1st Floor – Various Areas	Gray Wall Plaster Base Coat	(S)	Fair	High	None
44A	1st Floor – Display Window Area	White Ceiling Plaster Skim Coat	140 Sq Ft (T)	Fair	High	None
44B	1st Floor – Display Window Area	Gray Ceiling Plaster Base Coat	140 Sq Ft (T)	Fair	High	None
45A	1st Floor – Display Window Area	White Ceiling Plaster Skim Coat	(T)	Fair	High	None
45B	1st Floor – Display Window Area	Gray Ceiling Plaster Base Coat	(T)	Fair	High	None
46A	1st Floor – Display Window Area	White Ceiling Plaster Skim Coat	(T)	Fair	High	None
46B	1st Floor – Display Window Area	Gray Ceiling Plaster Base Coat	(T)	Fair	High	None
47	Front Exterior Store Windows	Gray Window Glazing	320 Ln Ft (U)	Fair	High	None
48	Front Exterior Store Windows	Gray Window Glazing	(U)	Fair	High	None

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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
49	Front Exterior	Beige / Gray Window Caulk	250 Ln Ft (V)	Fair	High	None
50	Front Exterior	Beige / Gray Window Caulk	(V)	Fair	High	None
51A	Throughout Basement	Brown 9x9 Floor Tile	2,600 Sq Ft (W)	Poor	High	2%
51B	Throughout Basement	Black Mastic	2,600 Sq Ft (W)	Poor	High	None
52A	Throughout Basement	Brown 9x9 Floor Tile	(W)	Poor	High	2%
52B	Throughout Basement	Black Mastic	(W)	Poor	High	None
53A	Basement – Various Areas	Brown 6" Cove Base	310 Ln Ft (X)	Poor	High	None
53B	Basement – Various Areas	Brown Adhesive	310 Ln Ft (X)	Poor	High	None
54A	Basement – Various Areas	Brown 6" Cove Base	(X)	Poor	High	None
54B	Basement – Various Areas	Brown Adhesive	(X)	Poor	High	None

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Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
55A	Basement Various Areas – Partition Wall	White Wall Plaster Skim Coat	670 Sq Ft (Y)	Poor	High	None
55B	Basement Various Areas – Partition Wall	Gray Wall Plaster Base Coat	670 Sq Ft (Y)	Poor	High	None
56A	Basement Various Areas – Partition Wall	White Wall Plaster Skim Coat	(Y)	Poor	High	None
56B	Basement Various Areas – Partition Wall	Gray Wall Plaster Base Coat	(Y)	Poor	High	None
57A	Basement Various Areas – Partition Wall	White Wall Plaster Skim Coat	(Y)	Poor	High	None
57B	Basement Various Areas – Partition Wall	Gray Wall Plaster Base Coat	(Y)	Poor	High	None
58A	Basement Various Areas – Partition Wall	White Wall Plaster Skim Coat	(Y)	Poor	High	None
58B	Basement Various Areas – Partition Wall	Gray Wall Plaster Base Coat	(Y)	Poor	High	None
59A	Basement Various Areas – Partition Wall	White Wall Plaster Skim Coat	(Y)	Poor	High	None
59B	Basement Various Areas – Partition Wall	Gray Wall Plaster Base Coat	(Y)	Poor	High	None

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Building Inspection Results

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Date: March 19, 2025
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License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
60	Basement – Various Areas Cold Water Line	Brown / White 3"- 4" TSI	250 Ln Ft (Z)	Fair	High	10%
61	Basement – Various Areas Cold Water Line	White / Brown 3"- 4" TSI	30 Visible (AA)	Fair	High	30%
62	Basement – Various Areas Cold Water Line	Brown 3"- 4" TSI	(Z)	Fair	High	5%
63	Basement – Various Areas Cold Water Line	White 3"- 4" TSI	(AA)	Fair	High	20%
64	Basement – Various Areas Cold Water Line	Brown / White 3"- 4" TSI	(Z)	Fair	High	5%
65	Basement – Various Areas Cold Water Line	White 3"- 4" TSI	(AA)	Fair	High	5%
66	Basement – Various Areas Hot Water Line	White / Brown 2"- 3" TSI	300 Ln Ft (BB)	Fair	High	2%
67	Basement – Various Areas Hot Water Line	White 2"- 3" TSI	42 Visible (CC)	Fair	High	40%
68	Basement – Various Areas Hot Water Line	White / Brown 2"- 3" TSI	(BB)	Fair	High	3%
69	Basement – Various Areas Hot Water Line	White 2"- 3" TSI	(CC)	Fair	High	20%

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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
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License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
70	Basement – Various Areas Hot Water Line	White / Brown 2"- 3" TSI	(BB)	Fair	High	2%
71	Basement – Various Areas Hot Water Line	Gray 2"- 3" TSI	(CC)	Fair	High	10%
72	Boiler Room – Flue	Silver / White Insulation	82 Sq Ft (DD)	Fair	High	90%
73	Boiler Room – Flue	Silver / White Insulation	(DD)	Fair	High	90%
74	Boiler Room – Flue	Silver / White Insulation	(DD)	Fair	High	90%
75	Boiler Room – In Boiler	Yellow / Black Insulation	140 Sq Ft (EE)	Fair	High	None
76	Boiler Room – In Boiler	Yellow / Black Insulation	(EE)	Fair	High	None
77	Boiler Room – Between Plates	Gray Breeching	120 Sq Ft (FF)	Fair	High	2%
78	Boiler Room – Between Plates	Gray Breeching	(FF)	Fair	High	2%

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Building Inspection Results

Client: Civil & Environmental Consultants, Inc.
Project: Irwin Borough Building
Job Number: CEC-25-03

Date: March 19, 2025
Inspector: Edgar King
License Number: **030716**

SAMPLE	LOCATION	DESCRIPTION	APPROX QUANTITY	CONDITION	POTENTIAL FOR DAMAGE	ASBESTOS CONTENT
79	Basement – Police Station – Office	Red / Black Paint Over Floor Tile Mastic	140 Sq Ft (GG)	Fair	High	None
80	Basement – Police Station – Office	Red / Black Paint Over Floor Tile Mastic	(GG)	Fair	High	None
81	Basement Police Station – Female Cells	White / Brown 3" - 4" TSI	(Z)	Fair	High	10%
82	Basement Police Station – Female Cells	White / Brown 3" - 4" TSI	(AA)	Fair	High	20%
83	Basement Police Station – Cell Area	White / Brown 2" - 3" TSI	(BB)	Fair	High	10%
84	Basement Police Station – Cell Area	White / Brown 2" - 3" TSI	(CC)	Fair	High	60%
85A	Police Station – Rear Steps	Gray Floor Tile	(F)	Fair	High	None
85B	Police Station – Rear Steps	Yellow Adhesive	(F)	Fair	High	None
86A	Police Station – Rear Steps	Gray Floor Tile	(G)	Fair	High	None
86B	Police Station – Rear Steps	Yellow Adhesive	(G)	Fair	High	None

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ASBESTOS INSPECTION QUESTIONNAIRE

Date of Inspection: 3-19-25 **Inspector:** Edgar Kings

Client: CEC

Location: Irwin Borough Bldg

Address: 424 Main St Irwin Pa.

County: Westmoreland

Please Circle One—

Purpose of survey: Demolition (Renovation) Real Estate Transaction Other
If other, explain: _____

This survey is: Complete (Limited)
If limited, explain Areas of Renovation only

The building is currently: (Occupied) Unoccupied

The general condition of the building is: Good (Fair) Poor

Number of buildings included in the survey: 1

Number of floors in the building: 2

Main exterior building component (i.e. yellow brick, concrete block, etc...):
Brick

Please answer Yes or No.

Was the basement included? yes **Was the attic included?** NA

Was the roof included? NO **Is a map included?** yes

Were any areas inaccessible? yes **If yes, explain:** 1st Fl Police Dept

Were you accompanied by anyone yes **If yes, who:** Mark Ramela

Were any commonly found materials not present?
(floor tile, plaster, window caulking, etc...) NO

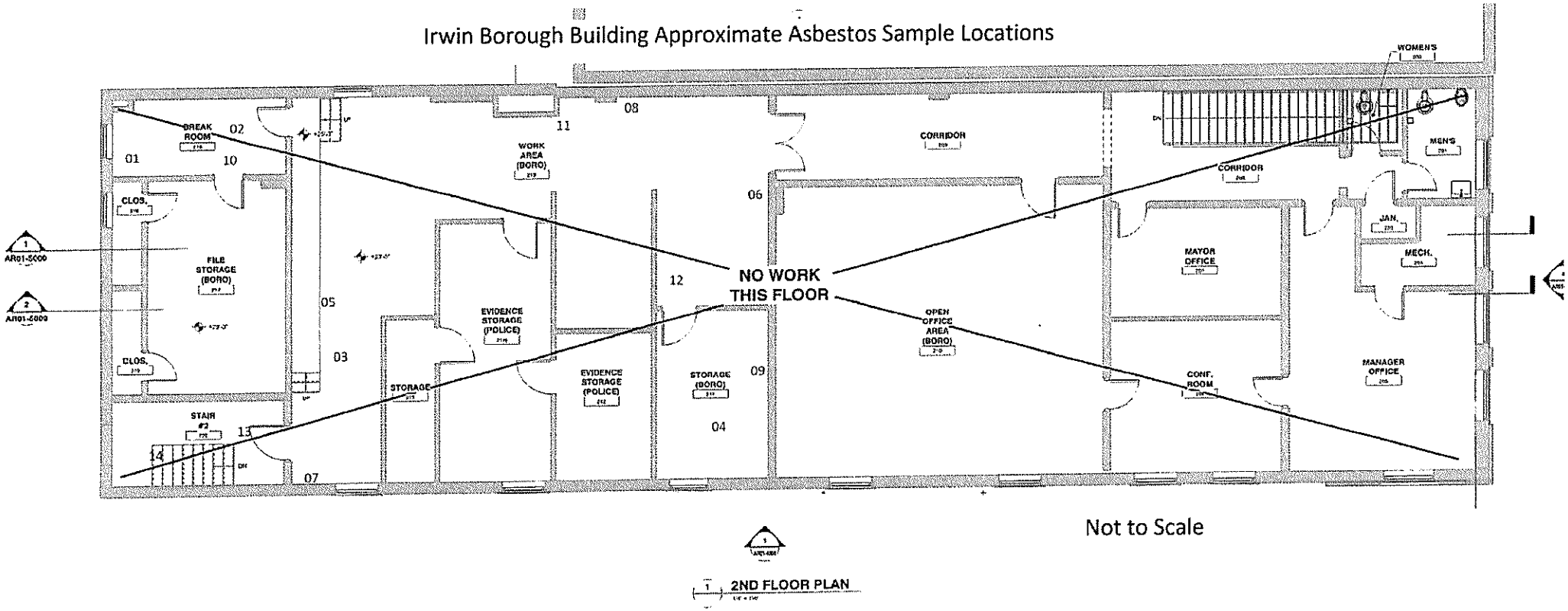
If yes, list and explain: _____

Any other important / relevant observations:
12 FMC Doors / assumed.

APPENDIX B

SAMPLE LOCATION DIAGRAMS

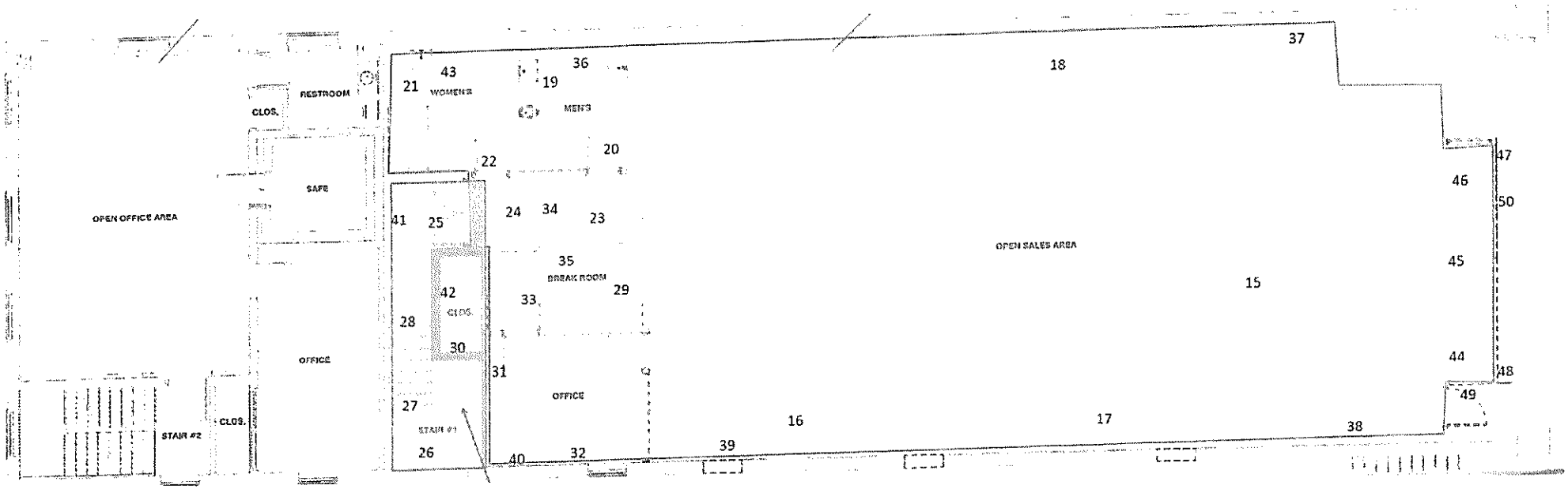
Irwin Borough Building Approximate Asbestos Sample Locations



Not to Scale

2ND FLOOR PLAN

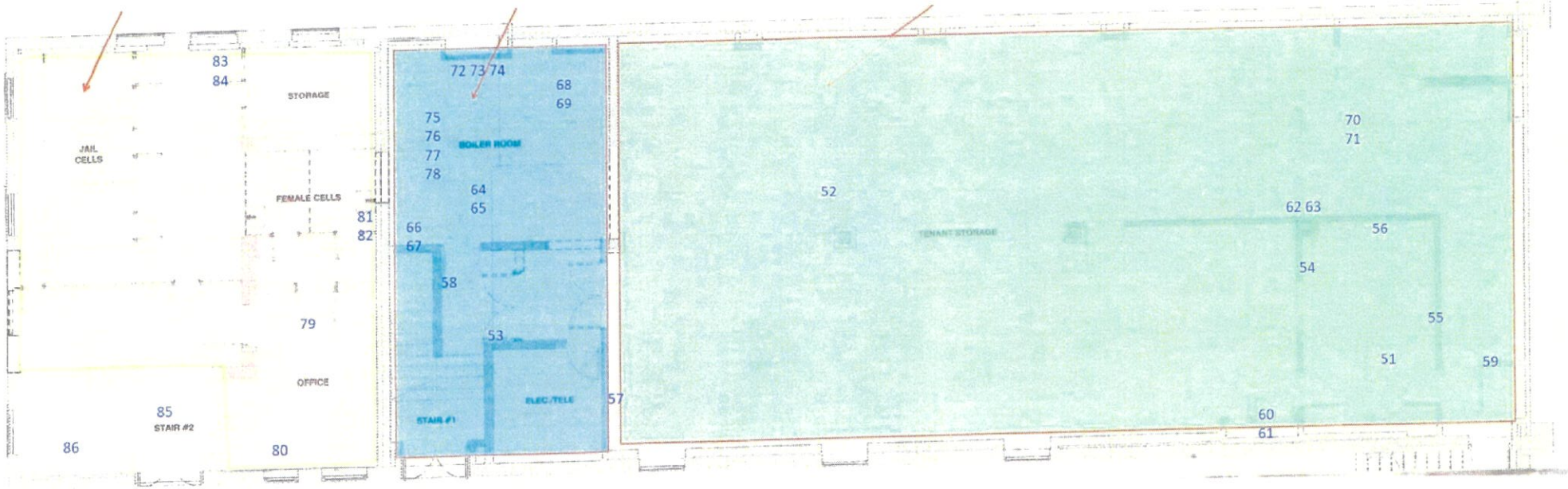
Irwin Borough Building Approximate Asbestos Sample Locations



First Floor

Not to Scale

Irwin Borough Building Approximate Asbestos Sample Locations



Basement

Not to Scale

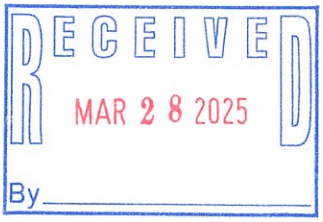
APPENDIX C

PLM LABORATORY ANALYTICAL RESULTS

AmeriSci Richmond
13635 GENITO ROAD
MIDLOTHIAN, VIRGINIA 23112
TEL: (804) 763-1200 • FAX: (804) 763-0493

March 27, 2025

Mid Atlantic Environmental Consultants, Inc
Attn: Tim Daniels
5320 North Pioneer Road
Gibsonia, PA 15044



RE: Mid Atlantic Environmental Consultants, Inc
Job Number 125031820
P.O. #CEC-25-03
CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Dear Tim Daniels:

Enclosed are the results for PLM asbestos analysis of the following Mid Atlantic Environmental Consultants, Inc samples received at AmeriSci on Friday, March 21, 2025, for a 5 day turnaround:

01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86

The 86 samples contained in zip lock bag were shipped to AmeriSci via Fed Ex. These samples were prepared and analyzed according to EPA PLM Method (EPA 600/R-93/116 Section 2.2). The required analytical information, analysis results, analyst signature and laboratory identification are contained in the PLM Bulk Asbestos Report. If TEM analysis was requested for selected samples the gravimetric reduction data (by Sec 2.3) and TEM Asbestos % (by Sec 2.5) are included in Table 1 along with a summary of Asbestos % by PLM for all samples analyzed.

This report relates ONLY to the sample analysis expressed as % asbestos. AmeriSci assumes no responsibility for customer supplied data such as “sample type”, "location", or “area sampled”. This report must not be used to claim product endorsement by AmeriSci, NVLAP or any agency of the U. S. Government. The National Institute of Standards and Technology accreditation requirements mandate that this report must not be reproduced, except in full, without the written approval of the laboratory. This report may contain specific data not covered by NVLAP or ELAP accreditations, if so identified in relevant footnotes.

AmeriSci appreciates this opportunity to serve your organization. Please contact us for any further assistance or with any questions.

Sincerely,

Glenn F. Massey

QA Manager | Authorized Signatory

AmeriSci Richmond
13635 GENITO ROAD
MIDLOTHIAN, VIRGINIA 23112
TEL: (804) 763-1200 • FAX: (804) 763-0493

PLM Bulk Asbestos Report

Mid Atlantic Environmental Consultants, Inc
Attn: Tim Daniels
5320 North Pioneer Road

Gibsonia, PA 15044

Date Received 3/21/2025
Date Examined 03/27/25

AmeriSci Job # 125031820
P.O. #

RE: CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
01	125031820-01L1	*Yes*	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor - Stage Entry/Kitchen **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
01	125031820-01L2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor - Stage Entry/Kitchen **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
01	125031820-01L3	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor - Stage Entry/Kitchen **Analyst Description:** Black, Heterogeneous, Fibrous, Tar Paper **Asbestos Types:** **Other Material:** Cellulose 60%, Non-fibrous 40%				
02	125031820-02L1	*Yes*	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor - Stage Entry/Kitchen **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
02	125031820-02L2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor - Stage Entry/Kitchen **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
02	125031820-02L3	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor - Stage Entry/Kitchen **Analyst Description:** Black, Heterogeneous, Fibrous, Tar Paper **Asbestos Types:** **Other Material:** Cellulose 60%, Non-fibrous 40%				

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
03	125031820-03L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Throughout **Analyst Description:** Green, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
03	125031820-03L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Throughout **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
03	125031820-03L3	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Throughout **Analyst Description:** Black, Heterogeneous, Fibrous, Tar Paper **Asbestos Types:** **Other Material:** Cellulose 60%, Non-fibrous 40%				
04	125031820-04L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Throughout **Analyst Description:** Yellow/Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
04	125031820-04L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Throughout **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
04	125031820-04L3	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Throughout **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Tar Paper **Asbestos Types:** **Other Material:** Cellulose 60%, Non-fibrous 40%				
05	125031820-05L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Walls **Analyst Description:** Brown/Green, Heterogeneous, Non-Fibrous, Cove Base **Asbestos Types:** **Other Material:** Non-fibrous 100%				

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
05	125031820-05L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Walls **Analyst Description:** Yellow, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 1.0%, Non-fibrous 99%				
06	125031820-06L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Walls **Analyst Description:** Brown/Green, Heterogeneous, Non-Fibrous, Cove Base **Asbestos Types:** **Other Material:** Non-fibrous 100%				
06	125031820-06L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Walls **Analyst Description:** Yellow, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 1.0%, Non-fibrous 99%				
07	125031820-07.1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Throughout **Analyst Description:** White, Heterogeneous, Non-Fibrous, Cementitious, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
07	125031820-07.2	***Yes***	Trace (<1.0 %) (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Throughout **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster) **Asbestos Types:** Chrysotile <1. % **Other Material:** Non-fibrous 100%				
08	125031820-08.1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Throughout **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
08	125031820-08.2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Perimeter Throughout **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				

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PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
09	125031820-09.1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: 2nd Floor Rear Area - Perimeter Throughout
Analyst Description: White, Heterogeneous, Non-Fibrous, Cementitious, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

09	125031820-09.2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: 2nd Floor Rear Area - Perimeter Throughout
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

10	125031820-10.1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: 2nd Floor Rear Area - Throughout
Analyst Description: White, Heterogeneous, Non-Fibrous, Cementitious, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

10	125031820-10.2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: 2nd Floor Rear Area - Throughout
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster)
Asbestos Types:
Other Material: Animal hair 1.0%, Non-fibrous 99%

11	125031820-11.1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: 2nd Floor Rear Area - Throughout
Analyst Description: White, Heterogeneous, Non-Fibrous, Cementitious, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

11	125031820-11.2	***Yes***	Trace (<1.0 %) (by CVES) by Eric H. Ahles on 03/27/25	

Location: 2nd Floor Rear Area - Throughout
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster)
Asbestos Types: Chrysotile <1. %
Other Material: Animal hair 1.0%, Non-fibrous 99%

12	125031820-12.1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: 2nd Floor Rear Area - Throughout
Analyst Description: White, Heterogeneous, Non-Fibrous, Cementitious, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
12	125031820-12.2	***Yes***	Trace (<1.0 %) (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Area - Throughout **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster) **Asbestos Types:** Chrysotile <1. % **Other Material:** Animal hair 1.0%, Non-fibrous 99%				
13	125031820-13L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Stairwell Landings **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%				
13	125031820-13L2	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Stairwell Landings **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
14	125031820-14L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Stairwell Stairs **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Stair Tread **Asbestos Types:** **Other Material:** Non-fibrous 100%				
14	125031820-14L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 2nd Floor Rear Stairwell Stairs **Analyst Description:** Yellow, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
15	125031820-15	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Showroom - Throughout/Office **Analyst Description:** White/Brown, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 100%, Non-fibrous Trace				
16	125031820-16	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Showroom - Throughout/Office **Analyst Description:** White/Brown, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 100%, Non-fibrous Trace				

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
17	125031820-17L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Beige, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
17	125031820-17L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
17	125031820-17L3	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Green, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
17	125031820-17L4	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
17	125031820-17L5	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Brown, Heterogeneous, Fibrous, Fiber Board **Asbestos Types:** **Other Material:** Cellulose 99%, Non-fibrous 1.0%				
18	125031820-18L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Yellow, Heterogeneous, Non-Fibrous, Carpet Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
18	125031820-18L2	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
18	125031820-18L3	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Showroom Throughout Under Carpet **Analyst Description:** Beige, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
19	125031820-19L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Men's Restroom **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
19	125031820-19L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Men's Restroom **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
20	125031820-20L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Men's Restroom **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
20	125031820-20L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Men's Restroom **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
21	125031820-21L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Women's Room **Analyst Description:** Red, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
21	125031820-21L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Women's Room **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 1.0%, Non-fibrous 99%				

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
22	125031820-22L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Women's Room **Analyst Description:** Red, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
22	125031820-22L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Women's Room **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%				
23	125031820-23L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Hallway **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%				
23	125031820-23L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Hallway **Analyst Description:** Yellow, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
24	125031820-24L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Hallway **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%				
24	125031820-24L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Hallway **Analyst Description:** Yellow, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
25	125031820-25L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Brown, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
25	125031820-25L2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
26	125031820-26L1	*Yes*	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Brown, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
26	125031820-26L2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%				
27	125031820-27L1	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Brown, Heterogeneous, Non-Fibrous, Stair Tread **Asbestos Types:** **Other Material:** Non-fibrous 100%				
27	125031820-27L2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Yellow, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
28	125031820-28L1	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Brown, Heterogeneous, Non-Fibrous, Stair Tread **Asbestos Types:** **Other Material:** Non-fibrous 100%				
28	125031820-28L2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor Rear Stairwell **Analyst Description:** Yellow, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				

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CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
29	125031820-29L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Break Room/Closet **Analyst Description:** Yellow, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
29	125031820-29L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: 1st Floor - Break Room/Closet **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%				
30	125031820-30L1	***Yes***	2.0% (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Break Room/Closet **Analyst Description:** Lime Green, Heterogeneous, Fibrous, Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
30	125031820-30L2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Break Room/Closet **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Synthetic fibers 3.0%, Non-fibrous 97%				
31	125031820-31L1	***Yes***	2.0% (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Office - Under Carpet **Analyst Description:** Black, Heterogeneous, Fibrous, Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
31	125031820-31L2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Office - Under Carpet **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 4.0%, Non-fibrous 96%				
31	125031820-31L3	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Office - Under Carpet **Analyst Description:** Black/Brown, Heterogeneous, Non-Fibrous, Backing/Mastic **Asbestos Types:** **Other Material:** Cellulose 35%, Non-fibrous 65%				

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
32	125031820-32L1	*Yes*	2.0% (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Office - Under Carpet **Analyst Description:** Black, Heterogeneous, Fibrous, Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
32	125031820-32L2	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Office - Under Carpet **Analyst Description:** Black/Brown, Heterogeneous, Non-Fibrous, Backing/Mastic **Asbestos Types:** **Other Material:** Cellulose 5.0%, Non-fibrous 95%				
33	125031820-33	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: Rear Hallway - Breakroom 1st Floor **Analyst Description:** Off-White, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%				
34	125031820-34	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: Rear Hallway - Breakroom 1st Floor **Analyst Description:** Lt. Gray, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%				
35	125031820-35L1	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Red, Heterogeneous, Non-Fibrous, Base Cove **Asbestos Types:** **Other Material:** Non-fibrous 100%				
35	125031820-35L2	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Cream, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
36	125031820-36L1	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Black, Heterogeneous, Non-Fibrous, Base Cove **Asbestos Types:** **Other Material:** Non-fibrous 100%				

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
36	125031820-36L2	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Cream, Heterogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
37	125031820-37.1	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
37	125031820-37.2	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Animal hair 2.0%, Non-fibrous 98%				
38	125031820-38.1	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
38	125031820-38.2	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Animal hair 2.0%, Non-fibrous 98%				
39	125031820-39.1	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
39	125031820-39.2	*No*	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				

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Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
40	125031820-40.1	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
40	125031820-40.2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Animal hair 2.0%, Non-fibrous 98%				
41	125031820-41.1	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
41	125031820-41.2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
42	125031820-42.1	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
42	125031820-42.2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Animal hair 2.0%, Non-fibrous 98%				
43	125031820-43.1	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				

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CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
43	125031820-43.2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor - Various Areas **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
44	125031820-44.1	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor Display Window Area **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
44	125031820-44.2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor Display Window Area **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
45	125031820-45.1	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor Display Window Area **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
45	125031820-45.2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor Display Window Area **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Animal hair 2.0%, Non-fibrous 98%				
46	125031820-46.1	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor Display Window Area **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
46	125031820-46.2	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: 1st Floor Display Window Area **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
47	125031820-47	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: Front Exterior Store Windows **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
48	125031820-48	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: Front Exterior Store Windows **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
49	125031820-49	***No***	NAD (by CVES) by Daisha Addison on 03/27/25	
Location: Front Exterior **Analyst Description:** Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
50	125031820-50	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Front Exterior **Analyst Description:** Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
51	125031820-51L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Throughout Basement **Analyst Description:** Brown, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
51	125031820-51L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Throughout Basement **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
52	125031820-52L1	***Yes***	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Throughout Basement **Analyst Description:** Brown, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
52	125031820-52L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Throughout Basement **Analyst Description:** Black, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%				
53	125031820-53L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement - Various Areas **Analyst Description:** Brown, Homogeneous, Non-Fibrous, Cove Base **Asbestos Types:** **Other Material:** Non-fibrous 100%				
53	125031820-53L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement - Various Areas **Analyst Description:** Brown, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
54	125031820-54L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement - Various Areas **Analyst Description:** Brown, Homogeneous, Non-Fibrous, Cove Base **Asbestos Types:** **Other Material:** Non-fibrous 100%				
54	125031820-54L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement - Various Areas **Analyst Description:** Brown, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				
55	125031820-55.1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Various Areas - Partition WG **Analyst Description:** White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				
55	125031820-55.2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Various Areas - Partition WG **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster) **Asbestos Types:** **Other Material:** Non-fibrous 100%				

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
56	125031820-56.1	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

56	125031820-56.2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

57	125031820-57.1	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

57	125031820-57.2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

58	125031820-58.1	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

58	125031820-58.2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

59	125031820-59.1	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: White, Heterogeneous, Non-Fibrous, Skim Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
59	125031820-59.2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Areas - Partition WG
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Cementitious, Base Coat (Plaster)
Asbestos Types:
Other Material: Non-fibrous 100%

60	125031820-60	*Yes*	10% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Area 3-4" TSI
Analyst Description: Brown/White, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 10%
Other Material: Cellulose 90%

61	125031820-61	*Yes*	30% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Area 3-4" TSI
Analyst Description: White/Brown, Heterogeneous, Non-Fibrous, Bulk Material
Asbestos Types: Chrysotile 30%
Other Material: Cellulose 10%, Fibrous glass 20%, Non-fibrous 40%

62	125031820-62	*Yes*	5.0% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Area 3-4" TSI
Analyst Description: Brown, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 5.0%
Other Material: Cellulose 95%

63	125031820-63	*Yes*	20% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Area 3-4" TSI
Analyst Description: White, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 20%
Other Material: Fibrous glass 30%, Non-fibrous 50%

64	125031820-64	*Yes*	5.0% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement Various Area 3-4" TSI
Analyst Description: Brown/White, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 5.0%
Other Material: Cellulose 95%

65	125031820-65	*Yes*	5.0% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement - Various Areas 3"-4" TSI
Analyst Description: White, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 5.0%
Other Material: Fibrous glass 40%, Non-fibrous 55%

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
66	125031820-66	*Yes*	2.0% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement - Various Areas 2"-3" TSI
Analyst Description: White/Brown, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 2.0%
Other Material: Cellulose 97%, Non-fibrous 1.0%

67	125031820-67	*Yes*	40% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement - Various Areas 2"-3" TSI
Analyst Description: White, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 40%
Other Material: Cellulose 10%, Fibrous glass 20%, Non-fibrous 30%

68	125031820-68	*Yes*	3.0% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement - Various Areas 2"-3" TSI
Analyst Description: White/Brown, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 3.0%
Other Material: Cellulose 95%, Non-fibrous 2.0%

69	125031820-69	*Yes*	20% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement - Various Areas 2"-3" TSI
Analyst Description: White, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 20%
Other Material: Cellulose 10%, Fibrous glass 20%, Non-fibrous 50%

70	125031820-70	*Yes*	2.0% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement - Various Areas 2"-3" TSI
Analyst Description: White/Brown, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 2.0%
Other Material: Cellulose 97%, Non-fibrous 1.0%

71	125031820-71	*Yes*	10% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Basement - Various Areas 2"-3" TSI
Analyst Description: Gray, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 10%
Other Material: Cellulose 20%, Fibrous glass 30%, Non-fibrous 40%

72	125031820-72	*Yes*	90% (by CVES) by Eric H. Ahles on 03/27/25	

Location: Boiler Room Flue
Analyst Description: Silver/White, Heterogeneous, Fibrous, Bulk Material
Asbestos Types: Chrysotile 90%
Other Material: Fibrous glass Trace, Non-fibrous 10%

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
73	125031820-73	*Yes*	90% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Boiler Room Flue **Analyst Description:** Silver/White, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 90% **Other Material:** Fibrous glass Trace, Non-fibrous 10%				
74	125031820-74	*Yes*	90% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Boiler Room Flue **Analyst Description:** Silver/White, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 90% **Other Material:** Fibrous glass Trace, Non-fibrous 10%				
75	125031820-75	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Boiler Room In Boiler **Analyst Description:** Yellow/Black, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 1.0%, Fibrous glass 99%, Non-fibrous Trace				
76	125031820-76	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Boiler Room In Boiler **Analyst Description:** Yellow/Black, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 1.0%, Fibrous glass 99%, Non-fibrous Trace				
77	125031820-77	*Yes*	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Boiler Room - Between Plates **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
78	125031820-78	*Yes*	2.0% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Boiler Room - Between Plates **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** Chrysotile 2.0% **Other Material:** Non-fibrous 98%				
79	125031820-79	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Police Station - Office **Analyst Description:** Red/Black, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
80	125031820-80	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Police Station - Office **Analyst Description:** Red/Black, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%				
81	125031820-81	*Yes*	10% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Police Station Female Cells 3"-4" TSI **Analyst Description:** White/Brown, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 10% **Other Material:** Cellulose 90%, Fibrous glass Trace				
82	125031820-82	*Yes*	20% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Police Station Female Cells 3"-4" TSI **Analyst Description:** White/Silver, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 20% **Other Material:** Cellulose 5.0%, Fibrous glass 15%, Non-fibrous 60%				
83	125031820-83	*Yes*	10% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Police Station - Cell Area - 2"-3" TSI **Analyst Description:** White/Brown, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 10% **Other Material:** Non-fibrous 90%				
84	125031820-84	*Yes*	60% (by CVES) by Eric H. Ahles on 03/27/25	
Location: Basement Police Station - Cell Area - 2"-3" TSI **Analyst Description:** Silver/White, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 60% **Other Material:** Cellulose Trace, Fibrous glass 10%, Non-fibrous 30%				
85	125031820-85L1	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Police Station - Rear Steps **Analyst Description:** Gray, Heterogeneous, Non-Fibrous, Floor Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%				
85	125031820-85L2	*No*	NAD (by CVES) by Eric H. Ahles on 03/27/25	
Location: Police Station - Rear Steps **Analyst Description:** Yellow, Homogeneous, Non-Fibrous, Mastic **Asbestos Types:** **Other Material:** Non-fibrous 100%				

See Reporting notes on last page

PLM Bulk Asbestos Report

CEC-25-03; CEC; Irwin Borough Bldg 424 Main St, Irwin, PA

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
86	125031820-86L1	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Police Station - Rear Steps
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Floor Tile
Asbestos Types:
Other Material: Non-fibrous 100%

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos	Notes
86	125031820-86L2	***No***	NAD (by CVES) by Eric H. Ahles on 03/27/25	

Location: Police Station - Rear Steps
Analyst Description: Yellow, Homogeneous, Non-Fibrous, Mastic
Asbestos Types:
Other Material: Non-fibrous 100%

Reporting Notes:

Analyzed by: Eric H. Ahles
Date: 3/27/2025

Reviewed by: Eric H. Ahles

*NAD = no asbestos detected, Detection Limit <1%, Reporting Limits: CVES = 1%, 400 Pt Ct = 0.25%, 1000 Pt Ct = 0.1%; "Present" or NVA = "No Visible Asbestos" are observations made during a qualitative analysis (Not covered by NVLAP or NY ELAP accreditations); NA = not analyzed; NA/PS = not analyzed / positive stop; PLM Bulk Asbestos Analysis using Meiji, Model MT 6130 microscope, Serial #1410298, by EPA 600/R-93/116 per 40 CFR 763 (NVLAP Lab Code 101904-0) and ELAP PLM Analysis Protocol 198.1 for New York friable samples which includes quantitation of any vermiculite observed (198.6 for NOB samples) or EPA 400 pt ct by EPA 600/M4-82-020 (NYSDOH ELAP Lab # 10984); CA ELAP Lab # 2508; Note: PLM is not consistently reliable in detecting asbestos in floor coverings and similar NOB materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos-containing in New York State (also see EPA Advisory for floor tile, FR 59, 146, 38970, 8/1/94). NIST Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the laboratory. This PLM report relates ONLY to the items tested.

125031820

Mid Atlantic Environmental Consultants

5320 N. Pioneer Road
Gibsonia, PA 15044
Phone: 724-444-3460 Fax: 724-444-3463
midatlantic@zoominternet.net

Chain of Custody Form

SAMPLE	LAB ID NUMBER	TYPE OF ANALYSIS	TURNAROUND TIME
01		PLM Asbestos	Standard
86			

Project Site: Irwin Borough Bldg 434 Main St Irwin Pa. Sampler Signature: JN# CEC-25-03

Client / Address: CEC Phone: Fax:

Email: Contact Name: Scott Moritzer

Relinquished By: Edgar Rios Date: 3-20-25 Time: 0845

Received By Date: Time:

Received By (AmeriSci) Date: Time:

Additional Information:

Please indicate our job # on all results and invoices.

Please email results to: midatlantic@zoominternet.net

Thank you!

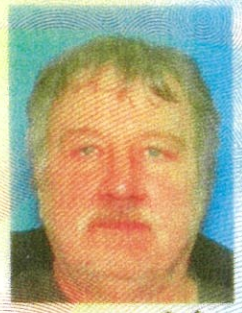
Received

MAR 21 2025

APPENDIX D

ACCREDITATION / LICENSING

PENNSYLVANIA ASBESTOS CERTIFICATION



030716

Birth Date
09/28/1962

EDGAR J KING
123 SIBERIAN AVE
LEECHBURG PA 15656

Expires	Issue Date
01/14/2026	02/12/2025

Sex	Height	Eyes
M	6' 02"	BLU

Class
INSPECTOR

PENNSYLVANIA ASBESTOS CERTIFICATION



047489

Birth Date
02/12/1964

MARK RAMELA
231 CREEK RD
ACME PA 15610

Expires
06/04/2025

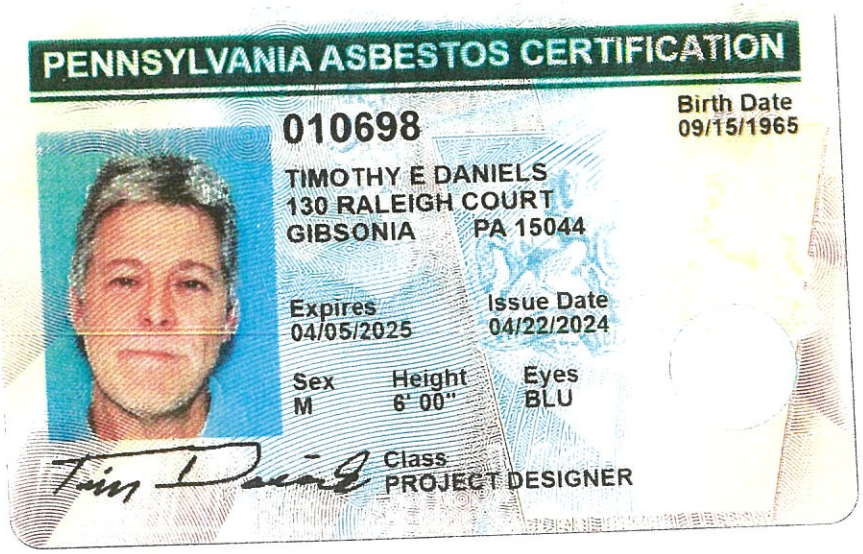
Issue Date
06/27/2024

Sex
M

Height
5' 07"

Eyes
BLU

Class
INSPECTOR


PENNSYLVANIA ASBESTOS CERTIFICATION
010698
Birth Date
09/15/1965
TIMOTHY E DANIELS
130 RALEIGH COURT
GIBSONIA PA 15044
Expires
04/05/2025
Issue Date
04/22/2024
Sex
M
Height
6' 00"
Eyes
BLU
Class
PROJECT DESIGNER