

PROPOSAL FORM
BALTIMORE COUNTY
DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION
TOWSON, MARYLAND

Division of Construction Contracts Administration

ARCHITECT

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Contract Number 25054 GX0
Property Management Project
Holt Memorial Park Enhancements –
34 Elmont Avenue, Baltimore, Maryland 21206
Overlea – District 14c6
Workday Number
PROJ-10001017

CONTRACT BASED ON SEPTEMBER 2023
STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS
AND STANDARD DETAILS FOR CONSTRUCTION

Bidders Information

A pre-bid meeting will be held on Wednesday, January 7, 2026 at 10:00 a.m. EST via WebEx. *Phone-In* (Audio Only) 1-415-655-0001, Meeting Number 2317 118 8593##. *Video Conference* go to <https://signin.webex.com/join> Meeting Number 2317 118 8593, **Password: bEuMYWCT782**, for Webex link go to: www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

Baltimore County First Source Hiring Agreement **see pages 880-881**. State Prevailing Wage Requirements & Wage Rates **see pages 882-888**.

(Contract Disclosure): “*Wage rates that are in effect as of the contract solicitation date will be the wage rates through the duration of the project*”

MBE/WBE Requirements & Forms **see pages 889-903**

THIS PROPOSAL FORM INCLUDES AND INCORPORATES ALL DOCUMENTS AND INFORMATION REFLECTED, LISTED, AND/OR REFERENCED IN THIS TABLE OF CONTENTS, AND ALL SUCH DOCUMENTS AND INFORMATION ARE PART OF AND INCORPORATED INTO THE CONTRACT DOCUMENTS.

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SECTION I

INFORMATION FOR BIDDERS

ELECTRONIC SUBMITTAL PROCESS

To be considered, Bids (Section IV – Proposal) shall be received by the bid closing date and time to the following email address dpwbid@baltimorecountymd.gov. The contract number and company name should be referenced in the Subject Line of the email. Bids may not be submitted by any other means. Bids that are mailed or otherwise delivered to the Purchasing Division (including emails which indicate links to locations where the bid may be downloaded) and/or emails sent to any other Baltimore County email address will not be accepted.

Late Bids will not be considered. Bidders are strongly encouraged not to wait until the last minute to submit bids. The time stated on the auto-receipt (described below) will be definitive of the time of receipt. Bids received after the deadline will not be accepted. Bidders are advised that the County cannot receive email attachments greater in size than twenty-five (25) megabytes and this size limitation may be further reduced by requirements of the Bidder's email provider which are beyond the control of the County. Bidder should consider separating any large bid attachment into multiple parts and emailing each part separately. In such case, Bidder will note that each email is *1 of 2, 2 of 2*, etc. Multiple part bids will not be considered unless all parts are received by the bid closing date and time.

After submitting a Bid to dpwbid@baltimorecountymd.gov, and upon successful receipt by the County thereof, Bidder will receive an auto-receipt email. This receipt is proof that the bid has been received by the Division of Construction Contracts Administration and should be retained for Bidder's records. In the case of a bid submitted in multiple parts as described above, an auto-receipt email will be generated for each part. The County has no obligation to consider any Bid for which an auto-receipt was not generated.

As with any system, power outages or technology problems may arise that are outside of the County's control and could affect your submission. The County will not be held accountable for such issues that may delay the transmission of any Bid.

NOTE: Electronic copy of the Bid Bond will be accepted at bid opening. The apparent low bidder is required to submit the original Bid Bond within ten (10) days after the bid opening to the Division of Construction Contracts Administration, 111 West Chesapeake Avenue, Room 300B, Towson, Maryland 21204.

INSTRUCTIONS AND SPECIFICATIONS

Refer to the enclosed proposal sheets for quantities to be bid upon. All proposals submitted on the attached form must give the price in clear figures for each item of the proposed work and be signed by the bidder with his name and address. Bidders must not change any item in the proposal for which a price has been stipulated by the County. Any change will cause rejection of the proposal.

NOTE: STATEMENT UNDER OATH FORM TO ACCOMPANY BID as per Baltimore County Purchasing Act 65-98, Section 15-94 and 15-95 which requires that the enclosed affidavit (see Proposal Affidavit pages in Section IV) be completed and submitted as part of the sealed bid.

Proposals made on any other than the attached form will not be considered. All papers included in, bound thereto, or attached to the Proposal Form are necessary parts thereof and shall not be detached, separated, or altered in their intent.

Changes in the phraseology of the proposal, additions, or limiting provisions will render the proposal informal or void and may cause its rejection.

All right is hereby reserved by the Purchasing Agent to reject any or all proposals and to waive formalities and technicalities as the interest of the County may require.

No successful bidder may withdraw his bid within NINETY (90) days after the opening thereof.

The successful bidder will be required to be bonded to Baltimore County, Maryland to the sum of One Hundred per Cent (100%) of the amount of his proposal or proposals according to the form of bond hereto attached for projects in excess of \$25,000.00.

This Proposal must be accompanied by a Bid Bond in an amount of 5% of the bid, the exact amount to be determined by the difference between the low bid and the next lowest bid if two or more bids are received, or 5% of the bid if one bid is received. This guarantees payment of the amount thus determined in case of a default in any matter specified as required before award or in any matter resulting in failure to execute and deliver an Agreement, together with Payment and Performance Bonds, after award. The Bid Bond must be in the form accompanying the Proposal executed by a Surety licensed in the State of Maryland. The Surety must be currently rated "B" or better by the A. M. Best Company, and the bid must be in an amount less than, or equal to, the underwriting limitation contained in Department of Treasury Circular 570 as amended at the time of the underwriting.

All work to be performed under this contract shall be done under strict compliance with Baltimore County Department of Public Works and Transportation September 2023 Standard Specifications for Construction and Materials and Standard Details for Construction and any and all proposed revisions thereto as of the date of advertisement and copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards, and all of which are made a part hereof and incorporated herein (collectively, the "Specifications").

If the bidder to whom an award is made shall fail to execute the contract and bond hereto attached and as herein provided, the award may be annulled and the contract awarded to the lowest responsible bidder who has consented to a time extension, and such bidder shall fulfill every stipulation embraced herein as if he were the original party to whom the award was made, or the Purchasing Agent may reject all of the bids as the interest of the County may require.

The Bid Bond of the three lowest bidders is deemed to be effective until the execution and delivery of the Contract Agreement, together with Payment and Performance Bonds for projects in excess of \$25,000.00 or until rejection of all bids, whereupon Surety is deemed relieved of all further obligations under the bid bonds provided.

Bidders must examine the drawings and specifications carefully and must make a personal examination of the location and nature of the proposed work. In case doubt shall arise as to the meaning or intent of anything shown on the drawings or comprised in the specification, inquiry shall be made of the Director of Public Works and Transportation at least five (5) days prior to the date of

bid opening. The submission of the Proposal shall indicate that the bidder thoroughly understands the drawings and the terms of the Specifications.

To better ensure fair competition and to permit a determination of the lowest bidder, unresponsive bids or bids obviously unbalanced may be rejected by the Purchasing Agent.

Bidders are required to fill out the total price column and total their proposals so that the result of the bidding, barring possible arithmetical errors, will be known at once. Any errors in computations will be corrected by the Engineer when the proposals are canvassed. Where the unit price and the total price are at variance, the unit price will prevail.

Bidders must be prepared to complete the work within the time stated in the proposal.

NOTE: ONLY CONTRACTORS FORMALLY PRE-QUALIFIED WITHIN THE ADVERTISED WORK CLASSIFICATION BY THE DIRECTOR OF PUBLIC WORKS AND TRANSPORTATION OF BALTIMORE COUNTY 10 CALENDAR DAYS PRIOR TO BID OPENING WILL BE ELIGIBLE TO SUBMIT BIDS.

Contracts for work under this proposal will obligate the contractors and subcontractors not to discriminate in employment practices. Bidders must, if requested, submit a compliance report concerning their employment practices and policies in order to maintain their eligibility to receive the award of the contract. Successful bidders must be prepared to comply in all respects with the Contract Provisions regarding nondiscrimination.

Baltimore County has adopted a Minority Business Enterprise (MBE) program and Women's Business Enterprise (WBE) Program. The percentage of participation applies to the contract amount awarded to the Contractor. Qualified minority subcontractors are those certified as being a Minority Business Enterprise by the following:

1. Maryland Department of Transportation Certification Committee (MDOT)
2. City of Baltimore, Minority Business Certification Council

Projects funded by the Federal Highway Administration are limited to the certification listed under #1 (MDOT).

More detailed information regarding the County's MBE/WBE Program can be obtained from the County MBE Office, telephone (410) 887-3407. See Executive Order dated December 6, 2022. MBE/WBE Participation Summary and Forms A, B, C, D and E enclosed in this proposal booklet.

NOTE: If you do not complete and submit the enclosed forms with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer **NON-RESPONSIVE** and accordingly the **COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.**

The County reserves the right to require the low bidder to produce evidence indicating that the company's financial condition is equal to, or better than, that enjoyed by the company at the time of prequalification. This additional information may be in the form of a financial statement or other evidence satisfactory to the Office of Budget and Finance.

Bidders' attention is directed to the requirement that a permit must be obtained from the Baltimore County Bureau of Highways and Bureau of Traffic Engineering prior to cutting any County

road for the purpose of obtaining sub-surface soils information, and permission must be obtained from the State Highways Administration prior to making any openings in a State road.

Under no circumstances shall a bidder enter upon any property outside a County or State road for the purpose of securing sub-surface soils information until permission is received from the property owner. The fact that the County has obtained a utility easement does not give the bidder the right to enter upon the property.

Prevailing index price of asphalt cement/ton \$630.00.

INCLEMENT WEATHER POLICY: If Baltimore County General Government Offices are open or open with liberal leave the day the bids are due, the bids are due as stated in the bid documents (date and time). **ONLY** when the Baltimore County General Government Offices are **OFFICIALLY CLOSED** the day the bids are due, the bid date will be postponed and an Addendum will be issued the next business (or next day buildings are officially open) day the county offices are open with the new bid date and time.

BID TABULATIONS: All bid tabulations will be confidential until after final award, at which time the total bid amounts for all bidders, as well as the complete bid tabulations for the top three (3) bidders, can be inspected by others when requested in writing pursuant to the Maryland Public Information Act.

ALTERNATIVE SOURCES OF CONTRACT BONDS: In the event your company is unable to qualify for bonding through a traditional commercial surety company, you may qualify for the required bonds through the State of Maryland, Department of Commerce (DOC). The **Maryland Small Business Development Financing Authority (MSBDFA, pronounced Mis-Bid-Fa)**, an agency of DOC, operates a Surety Bond Program designed to assist small businesses, based in Maryland, that are unable to obtain adequate bonding on reasonable terms in the commercial marketplace. MSBDFA provides bid, payment and performance bonds for contracts funded by government agencies, regulated utilities and private entities. The penal sums of the bonds are limited to the aggregate amount of \$2,500,000 and companies may pre-qualify for multiple bonds within pre-approved terms and conditions. MSBDFA also provides lines of credit, term loans and loan guarantees to help qualified businesses purchase equipment and real property, make improvements to leased property, refinance existing debt and assist them with their working capital needs. For more information on how to apply, you may contact: Meridian Management Group, Inc. (MMG), (the Program's Manager), 826 E. Baltimore Street, Baltimore, Maryland 21202, Telephone: (410) 333-4270. Or visit their website at www.mmcapitalgroup.com for information, applications and a checklist of required documents and reports that must accompany the application.

S E C T I O N I I

SPECIAL PROVISIONS

MAINTENANCE BOND

Per the Baltimore County Department of Public Works and Transportation September 2023 Standard Specifications for Construction and Materials, Section GP – 4.10 (C) states, the contractor is required to post a maintenance bond in the amount of five (5) percent of the total cost of the contract or withhold five (5) percent retainage for two (2) years from the date of Final Acceptance.

BALTIMORE COUNTY, MARYLAND

BOND NO. _____

CONTRACT NO. _____

MAINTENANCE BOND

THIS MAINTENANCE BOND is entered into on this _____ day of _____, 20____, by and between _____, as principal ("Principal") and _____, a business entity that is authorized to transact business in the State of Maryland and is organized and existing under the laws of the State of _____, as surety ("Surety"), are held and firmly bound unto Baltimore County, Maryland, a body corporate and politic of the State of Maryland ("County"), as Obligee.

WHEREAS, the above-named Principal has entered into a written contract known as Contract Number _____ dated _____, 20____ with Obligee for _____ (the "Agreement"), the terms of which are hereby incorporated by reference; and

WHEREAS, Principal has completed construction under the Agreement; and

WHEREAS, the Agreement includes a warranty on the quality of the Work performed that runs for a period of two (2) years from the date of the County's final acceptance and that runs for two (2) additional years beyond the repair date if any repair is done during the warranty period; and

WHEREAS, Principal is required to cause this instrument to be executed and delivered to Obligee as security for maintenance during the warranty period in an amount equal to 5% of the total value of the Contract.

NOW, THEREFORE, the Principal and Surety are held and firmly bound unto the Obligee in the sum of \$ _____ Dollars (\$ _____), lawful money of the United States of America, for the payment of which sum of money the Principal and Surety do bind themselves and their personal representatives, legal representatives, successors, and assigns, jointly and severally, firmly by this maintenance bond.

The conditions of this bond are as follows:

1. The Principal shall, for a period of two (2) years from and after the date of completion and acceptance of same by Obligee, replace all defects arising in the Work, whether resulting from defective materials, equipment, design furnished or workmanship. After such period, this obligation shall be null and void; otherwise it shall remain in full force and effect.

2. In the event of a default on the part of the Principal that may be the subject of a claim under this bond, Obligee shall mail, by certified mail, to Surety at the address listed below, a written statement that a claim is being made under the bond and, with substantial accuracy, the amount of the claim. Surety shall have no obligation to Obligee under this bond until the notice of claim is mailed.
3. When the Obligee has satisfied the condition of Paragraph 2 that a notice of claim be mailed, the Surety shall promptly and at the Surety's expense send an answer to Obligee within 30 days after the date of the claim. The answer shall state the amounts that are undisputed and the basis for challenging any amounts that are disputed. The answer shall be accompanied by payment (or arrangements for immediate payment) of any undisputed amounts.
4. Surety expressly waives any right to receive notice of extensions of time or alterations or modifications to the Agreement that may be granted by Obligee and agreed upon by Principal, and any such extensions, alterations, or modifications shall not affect the obligation of the Surety under this bond.
5. This bond is a specialty governed by the twelve-year statute of limitations period set forth in the Annotated Code of Maryland Courts and Judicial Proceedings §5-102.

WITNESS OR ATTEST:

(Principal – Contractor Name)

By: _____

Type Name: _____

Type Title: _____

Date: _____

(Surety)

By: _____

Type Name: _____

Type Title: _____

Type Address: _____

Date: _____

The Contract shall be done in strict compliance with the Baltimore County Department of Public Works and Transportation September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Construction", and any and all revisions thereto as of the date of the fully executed Contract, including but not limited to the General Conditions Building Projects, as applicable, and all of which are made a part hereof and incorporated herein (collectively, the "**Specifications**"). Copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards. **IN ADDITION, THE CONTRACTOR UNDERSTANDS AND AGREES THAT THE FOLLOWING SECTIONS OF THE SPECIFICATIONS (GP-1.03 AND GP-5-15) SHALL BE STRICKEN AND THE FOLLOWING SHALL BE INSERTED IN AND INCORPORATED INTO THE CONTRACT IN LIEU THEREOF:**

GP-1.03 ORGANIZATIONAL DEFINITIONS

Administration - Baltimore County.

Administrator - The Director of the Office of Budget and Finance, Baltimore County.

Baltimore County - Baltimore County, Maryland: a body corporate and politic.

Department - The word "Department" shall mean the Office of Budget and Finance of Baltimore County.

Engineer - One of the following engineering executives:

Director of Office of Budget and Finance
Chief, Property Management Division of the Office of Budget and Finance

Any delegation of the Engineer's authority must be authorized in writing by any one of the above listed officials, and such delegation of authority will pertain only to the specific contract and/or contracts shown by the authorization. The title of the specific official will appear in those cases within these specifications where the word "Engineer" as defined herein is not sufficiently specific.

Inspector - The authorized representative of the procurement officer assigned to make detailed inspection of any or all portions of the work, or materials therefor.

Procurement Officer - See Engineer.

GP-5.15 DISPUTES

(a) Except as otherwise may be provided by applicable law or regulation, all disputes arising under or as a result of a breach of this Contract that are not disposed of by mutual agreement shall be resolved in accordance with this General Provision.

(b) As used herein, "claim" means a: written demand or assertion by one of the parties seeking, as a legal right, the payment of money, adjustment or interpretation of Contract terms, or other relief, arising under or relating to this Contract.

A voucher, invoice, or request for payment that is not in dispute when submitted is not a claim under this General Provision. However, if the submission subsequently is not acted upon in a reasonable time, or is disputed either as to liability or amount, it may be converted to a claim for the purpose of this General Provision.

- (c) When a claim cannot be resolved by mutual agreement, the Contractor shall submit a written request for decision to the Department's Chief of the Property Management Division for his decision in consultation with the County Office of Law. The Contractor's written request shall set forth all the facts surrounding the controversy, including, but not limited to, those items listed in GP-5.14(b). Any claim by the County shall be decided in like manner.
- (d) The Contractor, at the discretion of the Engineer, may be afforded an opportunity to be heard and to offer evidence in support of his claim. Pending resolution of a claim, the Contractor shall proceed diligently with the performance of the Contract.
- (e) The Department's Chief of the Property Management Division shall decide any and all claims. The decision by the Department's Chief of the Property Management Division shall be issued within ninety (90) Days on matters of less than fifty thousand dollars (\$50,000) and within one hundred eighty (180) Days on matters of fifty thousand dollars (\$50,000) or more. The written decision of the Department's Chief of the Property Management Division shall be final and binding unless appealed in writing to the Director of the Department within thirty (30) Days of the Chiefs written opinion to the parties. If the Chiefs decision is timely appealed in writing to the Director of the Department, the Director of the Department, serving as referee, will review the written appeal submitted to assure all reasonable attempts were made to resolve the appeal.
- (f) The Director shall issue his/her decision in writing within ninety (90) Days. The Director's decision shall be final and conclusive unless a written appeal is mailed or otherwise filed with the County Administrative Officer within thirty (30) Days of the Director's written decision.
- (g) When the County Administrative Officer is satisfied all efforts at the Department level were made to resolve the dispute, a claim shall be resolved as follows:

 - (1) Subject to, and without in any way enlarging or limiting the other provisions of the Contract, the parties to any Agreement which adopts or incorporates by reference these Standard Specifications, appoint the County Administrative Officer as an administrative hearing officer pursuant to Article 25A, "Chartered Counties of Maryland", of the Annotated Code of Maryland.
 - (2) The parties further grant the County Administrative Officer the right to delegate this responsibility and authority in writing to a County official who is a registered professional engineer, independent of the Department of Public Works and Transportation's Division of Construction Contracts Administration, or to any other County official.
 - (3) For disputes involving ten thousand dollars (\$10,000) or more the decision of the administrative hearing officer shall be final and binding on both parties, subject only to such appeals on the record as provided by Article 25A. For disputes involving less than ten thousand dollars (\$10,000), the decision of the administrative hearing officer shall be final and binding on both parties.

GENERAL CONDITIONS

BUILDING PROJECTS



**Revised September 1, 2024,
in compliance with September 2023
Standard Specifications for Construction and Materials**

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BUILDING PROJECTS**

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GENERAL CONDITIONS DESIGN BUILD BUILDING PROJECTS

I. SPECIFICATIONS

Article 1 Applicable Specifications

All work performed under this Contract shall be done under strict compliance with the *Specifications* bound herewith, and with the *Baltimore County Standard Specifications for Construction and Materials* and the *Standard Details for Construction* dated September 2023 and subsequent addenda thereto, so far as the same may be applicable, copies of which are available on the County's website at www.baltimorecountymd.gov/departments/public-works/standards. These General Conditions are in addition to the aforementioned Specifications. Should there be any conflict with the aforementioned manuals, the *General Conditions* take preference.

II. DEFINITIONS

Article 2 Definitions

- A. *Architect and/or Engineer* shall mean the registered Architect and/or Engineer commissioned by the County to prepare the plans and contract documents.
- B. *Engineer* in these General Conditions and in the Construction Specifications in some instances refers to authorized representatives of the Office of Budget and Finance, Property Management.
- C. *Subcontractor*, as employed herein, includes only those having a direct contract with the Contractor. It includes one who furnished material worked to a special design according to the Plans and Specifications for the "work." It excludes one who merely furnished material not so worked.
- D. *Written Notice* shall be deemed to have been duly served if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered to or sent by registered mail to the last business address known to him who gives the notice.
- E. *Repair* means to restore after injury, deterioration, or wear; to mend, to renovate, by such means as appropriate, and to supply such materials and labor as necessary to render the item to be repaired sound, solid, true, plumb, square, even, smooth, and fully serviceable. Upon completion of such repair it must be, unless otherwise stated, rendered to such condition as to present a first-class finished work, or in instances where the repaired item serves as a base for additional finish, the repaired work must be such as to permit a first-class finish, to be applied without extra cost to the County. When the word "repair" is used in connection with machinery or mechanical equipment, it shall mean, in addition to the above, rendering the equipment completely serviceable and efficient, ready for the normal use for which it was originally intended.

- F. Some parts of the "Construction Specifications," bound herewith are of the abbreviated or "streamlined" type and includes incomplete sentences. Omissions of words or phrases such as "the Contractor shall", "in conformity therewith", "shall be", "as noted on the drawings", "according to the plans", "a", "an", "the", and "all" are intentional. Omitted words or phrases shall be supplied by inference in the same manner as they are when a "note" occurs on the drawings. Words "shall be" or "shall" will be supplied by inference when colon (:) is used within sentences or phrases.

Article 3 Time Limits

The proposal shall indicate whether the contract limit is based on Working Days or Calendar Days. If this is not indicated in the Proposal, then the time limits will be based on Calendar Days.

Article 4 Sunday, Night and Holiday Work

If Sunday, night or holiday work is necessary due to an emergency or is permitted by the Engineer, the Contractor shall secure and pay for any and all permits required in connection with this work.

III. CONTRACT DOCUMENTS AND SHOP DRAWINGS

Article 5 Contract Documents

A. Clarification

It is assumed that the Contractor has obtained clarification of all questions which may have arisen as to intent of the contract documents, or assumed, or actual conflict between two or more items in the Contract Documents as required in "Instructions to Bidders." Should the Contractor have failed to obtain such clarification as required by the "Instructions to Bidders," then the Engineer may direct the work to proceed by any method indicated, specified or required by the Contract Documents in the interest of maintaining the best construction practice. Such direction by the Engineer shall not constitute a claim for extra by the Contractor.

B. Jargon

Work described in words that have a well-known technical or trade meaning shall be held to refer to such recognized standard use.

C. Drawings

The Contractor shall do no work without proper drawings and instructions. Drawings are, in general, drawn to scale; however, symbols are used to indicate materials and structural and mechanical requirements. When symbols are used, the drawings are, of necessity, diagrammatic, as it is not possible to indicate all connections, fittings, fastenings, etc., which are included as a part of the work. Diagrammatic indication of mechanical piping, ducts, and conduit within the buildings is subject to adjustment in order to obtain proper grading, passage over, under or past obstructions, to avoid exposure in finished rooms and unsightly and obstructing conditions. The Contractor shall coordinate these adjustments.

1. Copies no longer Furnished

The County will no longer furnish the Contractor any copies of the Drawings and Specifications. Additional copies may be obtained by the Contractor downloading drawings and specifications from the Baltimore County Solicitation Web Page.

2. Copies of the Work

The Contractor shall keep in the office on the job a complete set of all drawings, specifications, shop drawings, schedules, etc., in good order and available to the Engineer and representatives of the County.

3. Ownership

All documents as furnished by the County remain the property of the County. They must not be used on other work but shall be returned to the County upon completion of the work.

D. Large Scale Detail Drawings

The Architect shall furnish, when necessary, additional instructions in the form of large scale developments of the drawings used for bidding, or to amplify Construction Specifications for the proper execution of the work. These shall be true developments of the bidding documents and reasonably inferable there from. The work shall be executed in conformity herewith. [See Article 6, Paragraph A.3.(c)]

E. Dimensions

The Contractor shall carefully check all dimensions prior to execution of the particular work affected. Whenever inaccuracies or discrepancies are found, the Contractor shall consult the Engineer prior to any construction or demolition. Should any dimensions be missing, the Engineer will be consulted and supply them prior to execution of the work. Dimensions for items to be fitted into constructed conditions at the job will be taken at the job and will be the responsibility of the Contractor. The obvious intent of the documents or obvious requirements dictated by conditions existing or being constructed supersedes dimensions or notes which may be in conflict herewith.

Whenever a stock size manufactured item or piece of equipment is specified by its nominal size, it is the responsibility of the Contractor to determine the actual space requirements for setting or entrance to the setting space. No extra will be allowed by reason of work requiring adjustment in order to accommodate the particular item of equipment.

Whenever new work, building, addition or portions thereof are not accurately located by plan dimensions, the Engineer will supply exact position prior to execution of the work.

Article 6 Shop Drawings

A. Shop Drawings (those prepared by the Contractor or Vendor of Material)

The Contractor shall submit for the Architect's approval, at such times as agreed (see Article 8), shop drawings (to include setting drawings and schedules) as required for the work of the various trades. These drawings shall be prepared in conformity with the best practice and standards for the trade concerned. Due regard shall be given to speed and economy of fabrication and erection.

1. Items to be Detailed

Shop details shall be supplied for all items which are specially fabricated for the work or when the assembly of several items is required of a working unit. Shop drawings are required for all reinforcing and structural steel, specially made or cut masonry units, miscellaneous metal work, specially made flashings or roofing and sheet metal work, specially made millwork, special rough hardware and all heating, ventilating, plumbing and electrical requiring special fabrication or detailed connections, including ducts.

2. Submissions

Shop drawings, brochures and catalog cut submissions shall consist of sufficient copies to provide for the retention by the Architect and County of five (5) copies total plus such additional copies as the Contractor may require. Drawings shall not exceed 24 in. x 36 in. in size.

3. Examination and Approval

The Contractor shall review all shop drawings, brochures and catalog cuts provided by the subcontractors and vendors prior to submitting them to the Architect. The Architect shall examine shop drawings with reasonable promptness, noting desired corrections, or granting approval.

a. Field Dimensions and Conditions

The Architect is not responsible for the checking of dimensions or existing conditions in the field. This is the sole responsibility of the Contractor.

b. Resubmission

When the Architect's notations or corrections are extensive, then the Contractor shall resubmit the drawings with changes made on the drawings.

c. Contractor's Responsibility

Unless the Contractor has in writing, notified the Architect to the contrary, at the time of submission, it will be assumed that the drawings are in conformity with the Contract Documents and do not involve any change in the Contract price or any change which will alter the space within the structure or alter the manner of operation from that contemplated in the Contract Documents.

d. Architect's Notations

Should the Contractor consider any change or notation received in compliance with paragraph (c) above as increasing the cost of the work from that contemplated in the Contract Documents, then the Contractor shall desist from further action relative to the item he/she questions and shall notify the Engineer, in writing, within five (5) days of the additional cost involved. No work shall be executed until the entire matter is cleared or a Change Order issued, or the Contractor is ordered by the Engineer to proceed under the provisions of the County's Standard Specifications. Failure of the Contractor to serve written notice, as above required, shall constitute a waiver of any claim in relation thereto.

(1) Similarly, should the Architect's notation or change involve less work than is covered by the Contract Documents, the Contractor shall allow the County the credit resulting from the change.

(2) Should the Contractor consider that any notation or change made by the Architect under provisions of this paragraph, paragraph (c), above, as involving a complete change in the subcontractor's relation or the substitution of a material different from that on which the Contract was based, then the Contractor shall act as herein stated or as in paragraph (c) above.

4. Project Completion

At the completion of the project, the Contractor shall submit a list of shop drawings for the entire project. This list shall contain the following information: title, description, specialty (Architectural, Structural, Mechanical, etc.), decision (no exceptions taken, approved, approved as noted, etc.).

Article 7 Separate Contracts

A. The County reserves the right to let other contracts in connection with paving and utilities adjoining this work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work, and shall properly connect and coordinate his work with theirs.

- B. If any part of the Contractor's work depends for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such work that render it unsuitable for such proper execution and results. Failure to inspect and report shall constitute an acceptance of the other contractor's work as fit and proper for the reception of the work, except as to the defects which may develop in the other contractor's work after the execution of the work.
- C. To ensure the proper execution of his/her subsequent work, the Contractor shall verify work already in place and shall at once report to the Engineer any discrepancy between the executed work and the drawings.

IV. PAYMENTS

Article 8 Payments

- A. Under this Contract payments will be made monthly on the valuation of work accomplished and on account of materials delivered on the site, for incorporation in the work, which are suitably stored.
- B. At the first of each month, the Contractor shall submit to the Engineer an application for payment on a form provided by the Engineer. Prior to application for first payment, the Contractor shall submit to the Engineer a schedule of values for the various parts of the work, including quantities, aggregating to the total sum of the Contract. This shall be so divided as to facilitate payment to subcontractors in accordance with Article 28, Paragraph C.1. The form of this submission shall be such as the Contractor or Engineer have agreed upon, and, if required, shall be supported by such evidence as to its correctness as the engineer may direct. This schedule, when approved by the Engineer, shall be used as a basis for approval of payment unless it is found to be in error. In applying for payment, the Contractor shall submit a statement based upon the schedule, itemized in such form and supported by such evidence as the Engineer may require, showing the Contractor's right to the payment claimed. If required, the Contractor shall show receipts and other vouchers for the payments for materials and labor including payments to subcontractors, as required by Article 28.
- C. Materials Purchased Under Allowance

The Engineer will provide schedules for all materials to be purchased from specified allowance.

Article 9 Approval of Payments

If the Contractor has made application, as above, the Engineer shall review and approve such payments as is decided to be properly due in accordance with the approved schedule. In approving such partial payments, there shall be retained no more than 10% of the total amount for the first 50% of the contract, after which only 5% of the total amount of the contract may be withheld unless the need is demonstrated for retaining more to protect the public interest.

Article 10 Payment Withheld

- A. The Engineer may withhold, or on account of subsequently discovered evidence, nullify the whole or a part of any payment to such extent as may be necessary to protect the County from loss on account of:
1. Defective work not remedied.
 2. Claims filed, or reasonable evidence indicating probable filing of claims, by parties other than the Contractor.
 3. Failure of the Contractor to make payments properly to subcontractors or for material or labor.
 4. A reasonable doubt that the Contract can be completed for the balance then unpaid.
 5. Damage to another Contractor.
 6. Failure of the Contractor to submit data required within the time limits stated in the Contract Documents.

Upon removal of the above, payment shall be made for the amounts withheld.

Article 11 Changes in Work

- A. The County, without invalidating the Contract, may order changes in the work by altering, adding to or deduction from the work, the Contract sum being adjusted accordingly. Such change shall be executed under these *General Conditions*. Extension of time made necessary thereby shall be adjusted at the time of such Change Order.
- B. The Engineer shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purpose of the project. Otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless a written order for the Office Budget and Finance, Property Management signed or countersigned by the Director has been received by the Contractor. No claim for addition to the Contract sum shall be valid unless so ordered.
- C. The value of any such extra work or change shall be determined in one or more of the following ways as determined by the Office of Budget and Finance, Property Management.
1. By Estimate and Acceptance of a Lump Sum
 - a. The prime Contractor shall furnish a breakdown of the estimated construction cost. The breakdown shall be of sufficient detail to describe the extra work and related costs for labor, material, overhead and profit.

b. Overhead and Profit

(1) Extra work by Subcontractor:

Subcontractor will be allowed 10% overhead and 10% profit added to the direct labor and material costs. The prime contractor will be allowed to increase the subcontractors total lump sum by 10% to cover his/her administration.

(2) Extra work by Prime Contractor:

The prime contractor will be allowed 10% overhead and 10% profit added to the labor and material costs.

- c. The prime contractor will be allowed 1 % for the bond added to the labor and material costs.
- d. The allowed overhead will include all supervision; no additional allowance will be made for it.

2. By Unit Prices Named in the Contract or Subsequently Agreed Upon

Such unit prices are to include all supervision, overhead, taxes, insurance and profit.

3. By Cost and a Fixed Fee

Added to the cost is a fixed fee portion which is to include supervision, overhead, insurance and profit.

4. By Force Account (Labor and Material Cost plus)

In accordance with the *Baltimore County Specifications for Construction and Materials* Section GP 9.02, the Contractor is allowed to add 65% mark-up.

- D. Should none of the methods stated in Paragraph C. 1, 2, or 3 be determined, the Contractor shall, providing he/she receives an order as defined in Paragraph B, above, proceed with the work on the basis of Paragraph C. 4. Force Account.

The Contractor and Engineer shall keep accurate costs, in such form as the Engineer may direct, for presentation, together with vouchers, to the Office of Budget and Finance Property Management for determination of the value of the work included in each Change Order. Pending determination of the final value, the Engineer may include payments for materials and labor, as stated in Article 8, in monthly vouchers.

Article 12 Claims for Extra Cost

No claim for extra will be granted which includes cost of delays or work stoppage due to strikes, lockouts, fire, avoidable casualties or damage or delay in transportation for which the County or its agents are not responsible. (See also Article 14.)

Article 13 Deductions for Uncorrected Work

If the Engineer and County deem it expedient to correct work injured or done not in accordance with the Contract, an equitable deduction from the Contract price shall be made therefore.

Article 14 Delays and Extension of Time

If no schedule or agreement stating the dates upon which drawings shall be furnished is made (see Article 8), then no claim for delay shall be allowed on account of failure to furnish drawings until two (2) weeks after demand for such drawings, and then not unless such claim is reasonable.

Article 15 Correction of Work After Final Payment

Neither the final certificate nor payment nor any provision in the Contract Documents shall relieve the Contractor of responsibility for faulty materials and workmanship. Unless otherwise specified, the Contractor shall remedy any defects and pay for any damage to other work resulting there from that appears within the guarantee period. The County shall give notice of observed defects with reasonable promptness. All questions arising under this Article shall be decided by the Director of Budget and Finance, Property Management.

Article 16 (Deleted)

Article 17 Assignment

The Contractor shall not assign the Contract. It shall not be sublet as a whole or sublet by trades or other portions in an amount of more than 75% of the monetary value of the Contract. The remaining 25% shall be executed by the Contractor with labor and materials directly purchased and paid for by the Contractor. Costs for insurance, over-head, supervisions, etc., may not be claimed as a portion of the 25% mentioned above. The execution of work by a subsidiary of the Contractor is not considered direct employment. The Contractor shall not assign any monies due or to become due to him/her hereunder, without the previous written consent of the County.

Article 18 Maryland State Sales Tax

- A. Contractors who are performing work for the State of Maryland or any of its political subdivisions are required to pay tax on materials and supplies which will be incorporated into the work.

- B. The Contractor must pay the tax on all equipment which is purchased, Even though it may be used on a job for the State of any of its political subdivisions.

V. MATERIALS

Article 19 Materials

Materials include all manufactured products and processed and unprocessed natural substances required for completion of the Contract. The Contractor in accepting the Contract is assumed to be thoroughly familiar with the materials required and their limitations as to use and requirements for connections, setting, maintenance and operation.

Whenever an article, material or equipment is specified and a fastening, furring, connection (including utility connections), bed or accessory is normally considered essential to its installation in good quality construction, such shall be included as if fully specified. Nothing in the Construction Specifications shall be interpreted as authorizing any work in any manner contrary to applicable law, codes or regulations (See Article 31).

A. Approval

All materials are subject to the Architect's or Engineer's approval as to conformity with the specifications, quality, design, color, etc. No work for which approval is necessary shall be contracted for, or used, until written approval is given by the Architect or Engineer. Approval of a subcontractor, as such, does not constitute approval of a material which is other than that included in the Construction Specifications.

B. New Materials

Unless otherwise specified, all materials shall be new.

C. Quality

Unless otherwise specified, all material shall be of the best quality of the respective kinds.

D. Samples

The Contractor shall furnish for approval all samples as directed. The work shall be the same as the approved samples.

E. Painting and Color

The Architect and Contractor shall jointly prepare the paint and color schedules. The Architect shall direct the exact color, texture and finish.

F. Proof of Quality

The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials either before or after installation. The Contractor shall pay for any tests as may be deemed necessary in relation to "Substitutions" (Paragraph I. below).

G. Contractor's Option

When several products or manufacturers are named in the Construction Specifications for the same purpose or use, then the Contractor shall select any of those so named. However, all of the units of a thing required for a project must be the same in material and manufacture.

H. "Or Equal", "Equal", "Approved Equal"

The above terms are used as synonyms throughout the Construction Specifications. They are implied in reference to all named manufacturers. Only materials that, in the opinion of the Engineer, are fully equal in all details of construction, methods of assembly, finish and design quality will be considered. (See A, C, E, above, and I. below.)

I. Substitutions

Should the Contractor desire to substitute another material for one or more specified by name, the Contractor shall apply, in writing, for such permission and state the credit or extra involved by the use of such material. The Engineer will not consider the substitution of any material different in type or construction methods unless such substitution effects a benefit to the County. (See A. and D. above.)

The Contractor shall not submit for approval, materials other than those specified without a written statement why such a Substitution is proposed. Approval of a "substitute" material by the Architect or Engineer when the Contractor has not designated such material is a "substitute," shall not be binding on the County nor release the Contractor from any obligations of the Contract, unless the Architect or Engineer approves such "substitutions" in writing.

J. Standard Specifications

Whenever references are made in the Contract Documents to the *Baltimore County Standard Specifications for Construction and Materials* and *Standard Details for Construction*, it shall be understood that the latest standards and/or requirements are intended and shall apply. When no specification is cited and the quality, processing, composition or method of installation of a thing is only generally referred to then:

1. For things not otherwise specified below, the latest edition of the Applicable American Society for Testing Materials Specifications shall apply.

2. For things covered by the applicable portions, the National Bureau of Fire Underwriters Code shall apply.
3. For things generally considered as plumbing and those things requiring plumbing connections, the applicable portions of the latest edition of the American Society of Mechanical Engineers Code and the Baltimore County Plumbing Code shall apply.
4. For things generally considered as heating and ventilating work and not covered by A.S.M.E. Code, the applicable portions of the latest edition of the Heating and Ventilating Guide, published by the American Society of Heating and Ventilating Engineers, and the Baltimore County Building Code shall apply.

K. Storage

The contractor shall confine apparatus and storage of materials to the "off-road" area delineated as the "Limit of Contract." The Contractor shall not load or permit any part of the structure to be loaded with a weight that will endanger the safety of the structure or any part thereof.

VI. **QUALIFICATION, EMPLOYEES, WORKMANSHIP, SUBCONTRACTORS AND ADVERTISING**

Article 20 Qualification of Bidders

Bidders are required to be prequalified 10 days prior to bid opening, satisfactorily evidencing that they have the ability, equipment, organization and financial resources sufficient to enable completion of the work satisfactorily within the time specified in the Proposal.

Article 21 Employees and Workmanship

A. Employees

1. Qualification

Only personnel thoroughly trained and skilled in the task assigned them may be employed on any portion of the work, or they shall be removed.

2. Licensed

When County, State or Federal laws require that certain personnel (electricians, plumbers, etc.) be licensed, then all such personnel employed on the work shall be so licensed.

B. Quality of Labor

The Contractor shall employ on the work, at all times, sufficient personnel to complete the work within the time stated in the Proposal.

C. Work Areas

The Contractor shall confine the operations of his/her employees to the limits as provided by law, ordinance, permits or directions of the Office of Budget and Finance Property Management. Generally, the "off-road" area will be the same as the "limit of Contract" line.

D. Methods and Quality

1. All workmanship shall be of good quality. Whenever the method of the work or manner of procedure is not specifically stated or shown in the Contract Documents, then it is intended that the best standard practice shall be adhered to. Recommendations of the manufacturers of approved materials shall be considered as a part of Construction Specifications and all materials shall be applied, installed, connected, erected, used, cleaned and conditioned as so called for thereby. This, however, does not remove any requirement in Construction Specifications to add to the manufacturer's recommendations.
2. All materials shall be accurately assembled, set, etc., and when so required in good construction, shall be true to line, even, square, plumb, level and regularly spaced, coursed, etc. Under no circumstances, either in new or old work, shall any material be applied over another which has not been thoroughly cleaned, sanded or otherwise treated so as not to impair the finish, adhesion, or efficiency of the next applied item.
3. All methods, procedures and results are subject to the Engineer's approval as to finished result to be obtained. However, this is not to be interpreted as placing upon the Engineer any responsibility for the "work" management which is solely the responsibility of the Contractor.

E. Joining of Work

1. The Contractor shall so schedule the work as to ensure efficient and uninterrupted progress and to hold to an absolute minimum the cutting and patching of new work. All cutting, patching and digging necessary to the execution of the work is included.
2. The Contractor shall so schedule (to include subcontracts) the construction performed by each group or trade that each installation or portion of the construction shall member with and join with all other work as required for a complete installation, all according to accepted good construction practice.

F. Superintendent

The Contractor shall keep on the work, at all times during its progress, a competent superintendent and all necessary assistants, all approved by the

Office of Budget and Finance Property Management. Prior to commencement of the work, the Contractor shall submit in writing to the Office of Budget and Finance Property Management the name and qualifications of the person to be employed as Superintendent for the execution of the Contract. A written approval or rejection will be given following review of the data. Persons who have previously proved unsatisfactory on work executed for the County, or who are without proper qualifications, will not be approved. Should the Superintendent be complained of by the Office of Budget and Finance Property Management for cause, he/she shall be removed from the work. Should it be necessary to change the Superintendent, the above procedure shall be repeated. The Superintendent will represent the Contractor. All directions given to the Superintendent shall be as binding as if given to the Contractor. Important directions shall be confirmed on written request in each case.

G. Discipline

The Contractor shall at all times enforce strict discipline and good order among his/her employees and shall not employ or permit to remain on the work any unfit person. The Contractor shall enforce all instructions relative to use of water, heat, power, no smoking, and control any use of fires, as required by law and for the Office of Budget and Finance Property Management. Employees must not be allowed to loiter on the premises before or after job working hours.

Article 22 Employment Lists

The Contractor may contact MARYLAND STATE EMPLOYMENT SERVICE, Towson, MD, 21204, if so desired, for additional labor regarding this project.

Article 23 Contractor's Supervision (Also see Article 21, Paragraph F.)

The Contractor shall constantly maintain efficient supervision of the work, using his/her best skills and coordinating ability. The Contractor shall carefully study and compare all drawings, specifications, and other instructions and check them against conditions existing or being constructed on the project. The Contractor shall report to the Engineer any error inconsistency or omission which may be discovered. (See also Article 5, Paragraph E, and Instructions to Bidders.) The Contractor shall not be held responsible for the existence or discovery of such errors or conflicts and neither shall the adjustment of such errors or conflicts be grounds for claim for extra on the art of the Contractor unless such adjustment involves work not obviously contemplated by the Contract Documents or necessary to progress of the work. The Contractor shall be responsible for the coordination of the work of all subcontractors.

Article 24 The County's Right to do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the County after three days' written notice to the Contractor may, without prejudice to any other remedy, make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor.

Article 25 County's Right to Terminate Contract

A. Terminate Contract

The Office of Budget and Finance, Property Management, upon proof that sufficient cause exists to satisfy such action, may without prejudice to any other right or remedy, and after giving the Contractor seven (7) days' written notice, terminate the employment of the Contractor and take possession of the premises and of all materials, tools, and appliances thereon and finish the work by whatever method may be deemed expedient, if any of the following conditions exists:

1. If the contractor should
 - a. Be adjudged a bankrupt or make a general assignment for the benefit of creditors,
 - b. Has a receiver appointed on account of insolvency.
 - c. Fails to or repeatedly and persistently refuses to supply properly skilled workers or proper materials, except in cases for which extension of time is provided,
 - d. Fails to make payment to subcontractors, or for materials and labor,
 - e. Persistently disregards laws, ordinances or the instructions of the Engineer, or
 - f. Is otherwise guilty of a substantial violation of any provision of the Contract.

2. Payment Status

In cases such as identified above, the Contractor shall not be entitled to receive any further payment until the work is finished. If the unpaid balance of the Contract price shall exceed the expenses of finishing the work, including compensation for additional managerial and administrative services, such excess shall be paid to the Contractor. If such expense shall exceed such unpaid balance, the contractor shall pay the difference to the County. The expense incurred by the County as herein provided, and the damage incurred through the Contractor's default, shall be itemized by the Engineer and a certified copy supplied to the Contractor.

Article 26 Sanitary Conveniences

- A. The Contractor shall arrange for the erection and Maintenance of temporary toilets equipped with running water and drain connection for use of employees. These conveniences shall be erected and kept clean and in good condition, as required by law, until ordered removed by the Engineer.
- B. In lieu of A. above, the Contractor may install a portable approved chemical toilet at an approved location.
- C. The permanent plumbing fixtures to be constructed under this Contract shall not be used during construction, under any circumstances.

Article 27 Subcontracts Deleted

Article 28 Relation of Contractor and Subcontractor

- A. **The Contractor agrees** to bind every subcontractor and every subcontractor agrees to be bound by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction the General Conditions*, the Drawings and Construction Specifications, as far as applicable, to his/her work, including the following provisions of this Article, unless specifically noted to the contrary in the subcontract approved in writing as adequate by the Office of Budget and Finance, Property Management.
- B. **The Subcontractor agrees** to be bound to the Contractor by the terms of the Agreement, *Baltimore County's Standard Specifications for Construction and Materials* and *Standard Details for Construction, General Conditions*, Special Provisions, Construction Specifications, and to assume towards him/her all obligations and responsibilities that he/she, by those documents, assumes towards the County.
 - 1. To submit to the Contractor applications for payment in such reasonable times as to enable the Contractor to apply for payment under Article 8 of these *General Conditions*.
 - 2. To make all claims for extras, for extensions of time and for damages for delays or otherwise, to the Contractor in the manner provided in *Baltimore County's Standard Specifications for Construction and Materials* or those *General Conditions* for like claims by the Contractor upon the County, except that the time for making claims for extra cost is one (1) week.

C. **The Contractor agrees** to be bound to the Subcontractor by all the obligations the County assumes to the Contractor under Agreement, *Baltimore County's Standard Specifications for Construction and Materials, General Conditions*, Drawings and Construction Specifications, and by all the provisions thereof affording remedies and redress to the Contractor from the County.

1. To pay the Subcontractors:

- a. Upon receipt of payment, if issued under the schedule of values described in *Baltimore County's Standard Specifications for Construction and Materials, G.P.- 9.03* or Article 8 of these *General Conditions*, the amount allowed to the Contractor on account of the Subcontractor's work, to the extent of the Subcontractor's interest herein.
 - b. Upon the receipt of payment, if issued otherwise than as in Paragraph C.1., above, so that at all times the total payments shall be as large in proportion to the value of the work done by him as the total amount certified to the Contractor is to the value of the work done by him/her.
 - c. To such extent as may be provided by the Contract Documents or the subcontract, if either of these provides for earlier or larger payments than the above.
 - d. On demand for his/her work or materials as far as executed and fixed in place, less the retained percentage, at the time the payment is requested, even though the Engineer fails to approve it for any cause not the fault of the Subcontractor.
 - e. A just share of any fire insurance money received by him/her, the Contractor, under Article 35 of these *General Conditions*.
2. To make no demand for liquidated damages or penalty for delay in any sum in excess of such amount as may be specified in the subcontract.
3. That no claim for services rendered or materials furnished by the Contractor to the Subcontractor shall be valid unless written notice thereof is given by the Contractor to the Subcontractor during the first ten (10) days of the calendar month following that in which the claim was originated.
4. To give the Subcontractor an opportunity to be present and to submit evidence in any manner involving his/her rights.

5. The Contractor and the Subcontractor agree that nothing in this Article shall create any obligation on the part of the County to pay to or to see to the payment of any sums to any Subcontractor.

Article 29 Interlocking Contracts

The attention of the Contractor and all Subcontractors is specifically called to the necessity of reading the Specifications covering items of the work which connect with or are dependent upon the work specified under each heading, and each Contractor executing the work called for there under shall be responsible for arranging for proper provision for connecting and coordinating his/her work with such other items.

Article 30 Advertising Signs

- A. The Contractor will furnish, erect and maintain a project sign for the duration of the project. The sign shall be placed on the site where and as directed by the Engineer. The sign shall be fastened to three posts spaced 4' apart. The posts shall be 4" x4", seven feet above ground and three feet below ground.
- B. The project sign is shown on page GC-27 in this book.

VII. LAWS, PERMITS, LICENSES, INSURANCE, AND BONDS

Article 31 Laws, Permits and Regulations

- A. Permit and Service Connections:
 1. **BUILDING PERMIT** - The County will obtain the building permit at no cost to the Contractor.
 2. **PERMANENT WATER SERVICE** - The County will apply for the water service and pay all related charges; i.e., water meter, water systems connection charge, water distribution charge and sewer systems connection charge. Total installation of the permanent water service is part of this Contract. Water service shall be installed by a County Prequalified Utility Contractor.
 3. **PLUMBING PERMIT** - The Contractor shall apply for the Permit; however, the County will pay all related charges and fees.
 4. **PERMANENT ELECTRIC SERVICE** - The Contractor shall apply for and pay for the electrical permit. The County shall obtain BGE permanent gas and electric service to the site at no cost to the Contractor.

The Contractor shall coordinate the installation of permanent gas and electric service with Baltimore Gas & Electric

Company. Both the gas and electric services shall be activated at the same time under one account number showing Baltimore County as owner. The Contractor shall be responsible for payment of consumption charges for the use of gas and electric energy obtained through the permanent service until the building is accepted by the County or until agreed upon by the County in direct coordination with the Building Services Division of Baltimore County. Charges from BGE for removal of existing electric service will be paid by the County.

5. **PERMANENT TELEPHONE SERVICE** - The County shall pay for the telephone service and systems to and in the building. The Contractor is responsible for supplying and installing all conduit, cables and junction boxes as shown on the drawings or called out in the Specifications.
 6. **CABLE** - The County shall pay for any cable television service into the building. The contractor is responsible for supplying and installing the remaining work as shown on the drawings and called out in the Specifications.
 7. **TEMPORARY SERVICES** -All temporary services, such as water, electric, telephone, etc., shall be the Contractor's entire responsibility. (Also see Article 46.)
 8. **MISCELLANEOUS PERMITS** - The Contractor shall procure any and all necessary permits not previously mentioned and pay any and all related charges and fees required and incidental to the due and lawful prosecution of the work.
- B. The Contractor shall give all notices and comply with all State and Federal laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the Drawing and Contract Specifications are at variance therewith, he/she shall promptly notify the Engineer, in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he/she shall bear all costs arising there from.

Article 32 Compensation, Liability, and Property Damage Insurance

(See Insurance Provision in Part VI of this Contract.)

Article 33 Builder's Risk Insurance

- A. The Contractor shall, at his/her own cost, insure the work and keep it insured at all times during the period of construction, and until final acceptance of it by the County, against loss or damage covered by

an "All Risk" Builders Risk type of policy. The amount of insurance shall be the 100% estimated replacement cost of the work.

- B. The policies shall be made payable to the County and the Contractor, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of construction.

Article 34 Guaranty Bonds

- A. Prior to signing of the Contract, the Contractor will be required to furnish bond covering the faithful performance of the Contract and the payment of all obligations arising there under, in such form as the County may prescribe with such sureties as the County may approve. The premiums shall be paid by the Contractor.
- B. The Bond to be in the amount of the total Contract price.
- C. At the direction of the Office of Budget and Finance, Property Management, the Contractor may be required to increase the above bond. Such addition will be paid for by the County in the amount of actual cost to the Contractor.

Article 35 Damages

- A. If either party to this Contract should suffer damages in any manner because of the wrongful act or neglect of the other party or of anyone employed by him/her, then reimbursement shall be made by the other party for such damage.
- B. Claims under this clause shall be made in writing to the party liable within a reasonable time at the first observance of such damage and not later than the time of final payment, except as expressly stipulated otherwise in the case of faulty work or materials, and shall be adjusted by agreement.
- C. Should the Contractor cause damage to any separate contractor on the work, the Contractor agrees, upon due notice, to settle with such contractor by agreement or refer the matter to the Office of Budget and Finance, Property Management, who will render a decision after hearing all evidence in the matter. The Contractor shall pay or satisfy such decision.

VIII. INSPECTION AND SURVEYS

Article 36 Inspection

- A. If the Construction Specifications, the Engineer's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Engineer timely notice of its readiness for inspection, and if the inspection is by another authority, the date fixed for such inspection. Inspections by

the Engineer shall be made promptly, and where practicable, at the source of supply. Any work covered without approval of the Engineer must, if required, be uncovered for examination at the Contractor's expense.

- B. If initial tests and/or inspections show substandard products, materials, workmanship, etc. and the Contractor elects, with the Engineer's approval, to perform additional tests and/or inspections to prove the acceptability of the substandard products, materials, workmanship etc., he/she shall perform same at his/her expense.

Article 37 Surveys

- A. The General Contractor shall, at his/her own expense, employ a registered surveyor to provide Elevation Bench Mark, and locate corners of the building and the limits of contract.
- B. The General Contractor shall, at his/her own expense, employ a competent field engineer, to give the lines and levels for the building, sidewalks and footings, etc. The Contractor will be responsible for all lines and levels and will guarantee all lines and levels as are shown on drawings.

Article 38 Unauthorized Work

Work done without lines and grades being established, work done beyond the lines and grades shown on the Plans or as established, except as herein provided, or any extra work done without written authority will be considered as unauthorized and at the expense of the Contractor and will not be measured by the Engineer, or paid for by the County. Work so done may be ordered by the Engineer to be removed and replaced at the Contractor's expense.

IX. CONSTRUCTION

Article 39 Construction Schedule

The Contractor shall hold bi-weekly "progress meetings" at the site, at a time suitable to the Engineer, at which the progress of the work shall be reported upon in detail with reference to schedules. Each interested subcontractor shall be required to have present a competent representative to report the condition of his/her branch of the work and to receive instructions. Minutes of these "progress meetings" shall be taken by the Contractor who shall type them for distribution to members of the conference, the Office of Budget and Finance, Property Management, and other interested persons. These minutes shall be received by all parties prior to the next scheduled "progress meeting."

Article 40 Protection of Work and Property

- A. All trees along the way of access shall be boxed, also all trees surrounding the building which are liable to injury by the moving, storing and working up of materials. No permanent tree shall be used for attachment of any ropes or derricks. Every public way, catch basin, conduit, tree, fence or things injured in carrying out this Contract, shall be replaced and put in good condition, unless the same shall be permanently done away with by order of the Engineer.
- B. The Contractor shall erect and properly maintain at all times as required by the conditions and progress of the work, all necessary safeguards for the protection of workers and the public and shall post danger signs warning against the hazards created by such features of construction as protruding nails, hod hoists, well holes, elevator hatchways, scaffolding, window openings, stairways and falling material.
- C. In an emergency affecting the safety of life, or of the work, or of the adjoining property, the contractor, without special instruction or authorization is hereby permitted to act, at his/her discretion, to prevent such threatened loss or injury, and he/she shall so act, without appeal, if so instructed or authorized. Any compensation claimed by the Contractor on account of emergency work shall be determined as outlined in Article 11.

Article 41 Shoring, Bracing and Sheeting

- A. The Contractor shall do all necessary shoring, bracing and sheeting required, or as directed by the Engineer, to carryout the work, install the foundations and other building construction, to protect the street, sidewalks and all adjoining buildings and property. He/she shall thoroughly brace and protect all earth banks sides of pits, trenches, and other excavations to prevent danger to persons or structures, and to prevent injurious cavings or erosion of any sort. Shoring and sheeting shall be removed after, or as, the walls are built and properly set.
- B. Full responsibility for both the design (by an Engineer licensed in Maryland) and the execution of all shoring, bracing, and sheeting work shall rest upon the contractor. While the Engineer shall be fully advised of all details for such work before the work itself is executed, this shall not in any way relieve the Contractor for full responsibility for all damage or expense arising from faulty installation of the said work of shoring, bracing, or sheeting.

Article 42 Tests

- A. Soils testing shall be performed by an independent testing firm arranged and paid for by the County.

- B. Materials testing shall be performed by an independent testing firm, paid for by the Contractor, which has previously been approved by the County and Architect/Engineer. Certified copies of all such test reports shall be submitted to the Engineer for approval.

Article 43 Cleaning Up

- A. The Contractor shall at all times keep the premises free from accumulations of waste material or rubbish caused by his/her employees or work, and at the completion of the work, shall remove all his/her rubbish from and about the project site, and all his/her tools, scaffolding and surplus material.

In case of dispute, the County may remove the rubbish and charge the cost to the several contractors as the Engineer shall determine to be just.

- B. All debris shall be kept sprinkled to reduce dust and shall be promptly removed from the building, and no combustible materials shall be stored against perimeter walls.
- C. The Contractor shall clean entirely the building as it is completed, wash all windows, scrub all floors at least once, and leave all floors free from spots and blemishes. The interior of the building and the project area shall be left "broom clean," or its equivalent.

Article 44 As-Built Drawings

The Contractor shall, as the project progresses, neatly record on a set of white prints any changes and all revisions to the work wherever they shall differ from the Contract Drawings. Upon completion of the work, the Contractor shall turn over to the Architect this set of prints.

Article 45 Drainage and Pumping

The Contractor shall remove all water, including rain water, encountered during the entire progress of the work, using pumps, drains or other methods approved by the Engineer. Excavations and the project site shall be kept free from water until all backfilling is completed. The water shall be discharged to catch basins, or other drainage points as directed by the Engineer.

Article 46 Temporary Water, Electric and Other Services

- A. The Contractor shall arrange for and pay for the installation of temporary connection to the County's water mains, including all incidental fees and expenses for water supply during construction of the project, and shall pay for all water used. Wasting of County water will not be permitted.

- B. The Contractor shall arrange for and pay for temporary electric light and power service required during construction of the project, and shall pay for all electricity used. Gasoline or other torches for lighting will not be permitted.
- C. The Contractor shall provide and pay for any other temporary services which may be required for the satisfactory completion of the project.
- D. The Contractor shall provide, at his/her own expense, all cold weather protection, temporary heat and fuel as necessary to carry on the work expeditiously during inclement weather, to protect work and materials against injury from dampness and cold, to dry out the building and provide suitable working conditions. Refer to other sections for temperatures required for work under the various trades

The methods of heating and type of fuel and equipment used shall be subject to approval by Engineer.

With special permission, in writing, permanent heating system may be used to dry out building and provide suitable working conditions in all or various parts thereof as soon as practicable. If used, Contractor shall be responsible for use of permanent heating system for purpose described and all costs of fuel, attendance, etc. in connection therewith shall be borne by him/her. Such use shall not relieve Contractor of his/her responsibility to turn over system to Owner in perfect condition on completion of project, including the removal of all dust of construction from air handling units, etc., the replacing of all filters, etc., nor shall it shorten stipulated guarantee period which will commence upon the date of final acceptance of the work.

Article 47 Connecting to Existing Utilities

The Contractor shall, at his/her own cost and expense and as part of this work under the Contract, furnish all labor, materials, tools, and appliances, and do all work required for making connections to existing storm drains, sanitary sewer, water, gas and electric service connections, as shown on drawings, and the cost of making such connections shall be included in his/her bid.

Article 48 Existing Utilities Shown on Plans

Water mains, gas mains, storm drains, sanitary sewers, and other utilities are shown on the Plans, in accordance with the best information available, for the information of the Contractor. The County assumes no responsibility for accuracy or completeness of the information shown. Existing mains and services shall be carefully protected and any damage to them caused by the work shall be immediately repaired to the satisfaction of the Engineer by the Contractor at his own expense, using materials of the quality and kinds damaged.

X. MISCELLANEOUS ADDENDA

Article 49 Holidays

The word "holidays" used in these Contract Documents shall be taken to mean the below listed holidays, which in Baltimore County, occur as shown below:

January 1	New Year's Day
3rd Monday in January	Martin Luther King's Birthday
3rd Monday in February	President's Day
4th Monday in May	Memorial Day
June 19	Juneteenth Independence
July 4	Independence Day
1st Monday in September	Labor Day
2nd Monday in October	Indigenous Peoples' Day
November 11	Veteran's Day
4th Thursday in November	Thanksgiving Day
December 25	Christmas
All Days of General Elections	

If any holiday occurs on Sunday, the following Monday shall be considered a holiday. If the holiday occurs on Saturday, the Friday immediately preceding shall be considered a holiday.

Article 50 Buy American Steel Act

The State of Maryland has approved House Bill No. 1659 to "Buy American Steel" for all Public Works projects in the State of Maryland, effective July 1, 1978. Compliance with Article 20.17 Metal Pipe (Page 100) and Article 20.18 Metal for Structures (Page 102) in the *S.H.A. Specifications for Materials, Highways, Bridges and Incidental Structures* dated March 1968 will satisfy this condition. Also see *Baltimore County's Standard Specifications for Construction and Materials* Section GP 7.28.

Article 51 Guarantee

- A. The Contractor guarantees all work against faulty or imperfect materials, against all imperfect or careless and/or unskilled workmanship, against all leaks and against all mechanical and electrical failure of equipment for a period of two (2) years from the date of acceptance of the project by the County. See other Sections of this Specification for other guarantees.
- B. The Contractor shall remove, replace or re-execute, without cost to the Owner, any work found to be imperfect during the guarantee period.

Article 52 Offices and Telephones

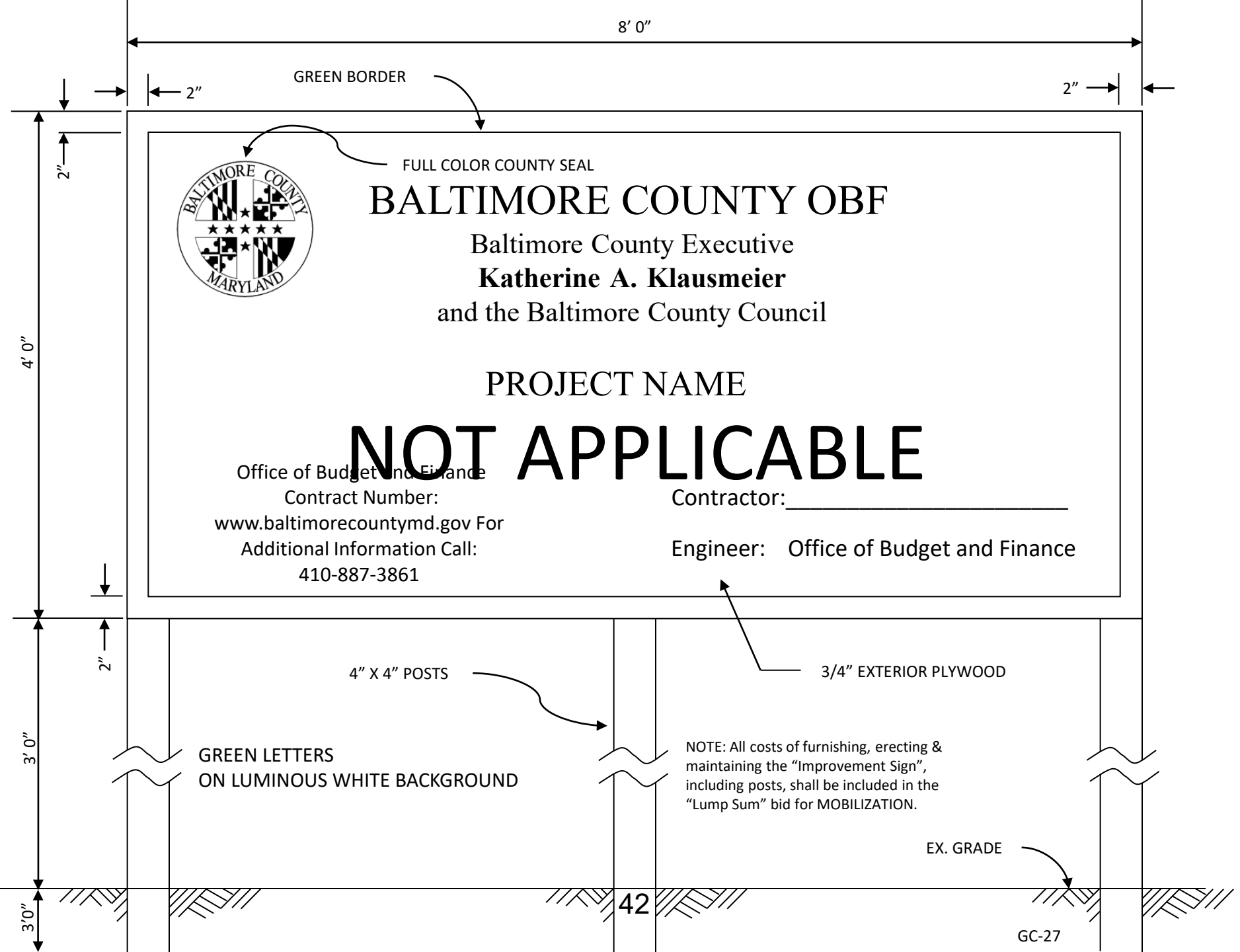
- A. The Contractor shall erect and maintain upon the project site, and where directed by the Engineer, suitable offices for his/her own use and that of the Engineer.

- B. A room of adequate size shall be provided and maintained in the Contractor's office to be used for "Progress Meetings," which frequently involve fifteen (15 or more persons). This space shall be so arranged that they can be held without interference with or from the other office or supervisory work. The room shall be 300 sq. ft. minimum and 10 ft. minimum width.

These offices shall be provided with adequate heating and lighting, all at the expense of the Contractor. In addition to the above requirements, air-conditioning will be required, the cost of which is to be included in the lump sum bid price. The system must be capable of maintaining a temperature of 80 degrees F dry bulb and approximately 50% relative humidity in the conditioned area when outside temperatures are 95 degrees F dry bulb and 78 degrees F wet bulb.

- C. The Engineer's office shall meet or exceed all requirements for a Type 1 office in accordance with *Baltimore County's Standard Specifications for Construction and Materials*, Section 103 Engineer's Office.

The Contractor shall provide telephone and FAX service in the Office of the Engineer. The Contractor shall pay all costs of installation and all charges for local and Baltimore City calls, but will not be expected to pay for long distance calls made from the Engineer's Office.



PROJECT MANUAL
FOR
HOLT PARK
BUILDING IMPROVEMENTS
BALTIMORE COUNTY, MARYLAND

34 Elmont Avenue,
Baltimore, Maryland 21206

Contract Number – 25054 GX0
Job Order Number - 0000971385

BALTIMORE COUNTY OFFICE OF BUDGET & FINANCE – PROPERTY MANAGEMENT

100% CONSTRUCTION DOCUMENTS
NOVEMBER 4, 2025

A/E Design Team

Architect: **Murphy & Dittenhafer Architects**, Baltimore, MD

Mechanical/Plumbing/Electrical Engineers: **BOWMAN**, Baltimore, MD

Structural Engineers: **Columbia Engineering**, Columbia, MD

Professional Cost Estimator: **MK Consulting Engineers**, Baltimore, MD

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Baltimore, Maryland 21206

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NOT USED

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NOT USED

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NOT USED

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SECTION 01 10 00 – SUMMARY OF WORK

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. Related Requirements:
 - 1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
- B. Section Includes:
 - 1. Project information
 - 2. Work Covered by Contract Documents
 - 3. Contractor's Use of Site and Premises
 - 4. Work Restrictions
 - 5. Specifications and drawings conventions

1.3 DEFINITIONS

- A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 PROJECT INFORMATION

- A. Project Identification: Holt Park Building Improvements
- B. Project Location: 34 Elmont Avenue
Baltimore, Maryland 21206
- C. Project Number: Contract Number: 25054 GX0
Job Order Number: 0000971385
- D. Owner: Baltimore County, Maryland in care of Property Management
 - 1. Owner's Representatives:
 - a. Baltimore County Property Management – Bill Sherd Property Management – Office of Budget & Finance 12200 Long Green Pike Glen Arm, MD 21057
- E. Architect: Murphy & Dittenhafer Architects, Inc. 805 North Charles Street; Baltimore, Maryland 21201; Ph: 410-625-4823

- F. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Structural Engineer: Columbia Engineering, Inc.; 6210 Old Dobbin Lane #150; Columbia, MD 21045; 410-992-9970
 2. M,E,P Engineer: Bowman Consulting Group, LTD; 300 East Joppa Road Suite 501; Towson, MD 21286; 410-494-1111

1.5 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of this project is defined by the Contract Documents and includes, but is not limited to, the following:
1. The buildings included in the scope are the Arts Center with attached Greenhouse, the Garden Cabin, the Nature Cabin, 112 McCormick Cabin, and detached Garage associated with 112 McCormick Cabin. Work will be focused on stabilization, repair of existing conditions, improving ADA accessibility, selective renovations, and an ADA restroom addition, and in-kind replacement of selective hvac equipment. The scope of work only covers the existing structures.
 2. The Arts Center, constructed c. 1900, and log cabins, believed to be constructed in the 1930s, are historic and should be preserved to the greatest extent possible. New materials used for repairs and renovations will be carefully selected to match or coordinate with the existing historic fabric. The design team is recommending minimal interventions in order to minimize the impact on the historic character of the cabins.
 3. The Arts Center scope includes renovations to the Greenhouse and repairs to the brick pavers.
 4. The Garden Cabin scope includes a new ADA restroom addition to the north side of the cabin, replacing the exterior wood siding with cement siding, and other minor repairs and upgrades.
 5. The Nature Cabin scope includes reconstruction of the front porch as well as other structural repairs, replacing the exterior wood siding with cement siding, and interior casework.
 6. The 112 McCormick Avenue Cabin scope includes renovations to raise the floor in the existing Kitchen area and reconfiguration of the addition to provide an ADA restroom.
 7. The Garage scope includes sealing of the concrete slab and storage shelving.
- B. Type of Contract:
1. Project will be constructed under a General Construction Contract.
- C. Removal and disposal of materials:
1. Non-hazardous materials shall be removed in accordance with Specification Section 01 74 19 – Construction and Demolition Waste Management and Disposal.
 2. Asbestos containing materials and other hazardous materials have not been documented in a report as part of the contract documents. Any hazardous materials encountered shall be abated and treated as construction debris. Refer to specification 02 81 00 – Transportation and Disposal of Hazardous Materials. The Contractor is responsible for coordinating the proper removal of all hazardous materials during demolition work. All hazardous materials abatement packaging, transport, and disposal must be performed in strict compliance with all applicable local, state, and federal regulations, latest edition. The

Contractor must maintain all licenses and certifications, in accordance with these regulations, which must be current for the entire term of this agreement.

- D. LEED Certification:
 - 1. None required.
- E. Refer to Bid Documents for other contract requirements.

1.6 SITE AND PREMISES

- A. Unrestricted Use of Site: Contractor shall make full use of Project site for construction operations during construction period only at 112 McCormick Cabin. Contractor's use of Project site at 112 McCormick Cabin is limited only by Owner's right to perform work or to retain other contractors on portions of Project. All other areas of the site will be partially occupied during construction.
- B. Restricted Use of Site: Contractor shall make use of allocated portions of the Project site for construction operation during construction period. The site will be partially occupied throughout the duration of the construction. A construction schedule shall be coordinated with Park activities and submitted by the GC in advance of starting work.

1.7 WORK RESTRICTIONS – AS NOTED IN BID DOCUMENTS

1.8 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section divisions found in this Project Manual.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

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 substitutions made after award of the Contract.

1.3 DEFINITIONS

- A. Substitutions: Products considered to be able to perform the same function but not necessarily have the same design, arrangement, details, utility requirements and/or dimensions. Changes in products, materials, and equipment required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1. Revisions to the Contract Documents requested by the Owner or Architect.
 - 2. Specified options of products or “approved equals” as permitted and included in the Contract Documents.
 - 3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.
- B. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
- C. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. General: No substitution requests will be considered from manufacturer's representatives or product vendors unless submitted through the Contractor. No substitution requests will be considered during the bid period. Bids shall be based on products from one of the manufacturers specified or an “or equal” product.
- B. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

- a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of 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 substitutions 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 as well as 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. Detailed comparison of Contractor's construction schedule using proposed substitutions 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.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. 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.
 - l. 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.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within (7) 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 (8) days of receipt of additional information or documentation, whichever is later.
 - a. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 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.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 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. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - 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 (60) days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- 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. Substitution request is fully documented and properly submitted.
 - 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.

HOLT PARK BUILDING IMPROVEMENTS
BALTIMORE COUNTY, MARYLAND
CONTRACT NUMBER – 25054 GX0
JOB ORDER NUMBER – 0000971385

PROJECT MANUAL
100% CONSTRUCTION DOCUMENTS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

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 handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Division 01 Section "Project Management and Coordination" for requirements for forms for contract modifications.

1.3 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.

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by the Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within (14) 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.

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

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Change Proposal Request, the Contractor will issue a Change Order for signatures of Owner and Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: The Architect may issue through Owner a Construction Change Directive. Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The 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 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

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 necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

- A. 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 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 (5) days post notice to proceed.
- 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. Owner's name.
 - c. Owner's Project number.
 - d. Name of Architect.
 - e. Architect's Project number.
 - f. Contractor's name and address.
 - g. Date of submittal.
 - 2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or division.

- b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Principal subcontract amounts should be broken down into multiple Items. Each Item should be complete including its total cost and proportionate share of general and administrative overhead and profit. All dollar amounts should be rounded to the nearest whole dollar. The total of all the Items should equal the Contract price
- a. The maximum value of any activity is \$25,000.
4. 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.
- a. Differentiate between items stored on-site and items stored off-site.
5. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling (5) percent of the Contract Sum and subcontract amount.
7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.
8. Submittal for preliminary and monthly progress submittals for Building Product Calculator (BPC), Construction and Demolition Waste Management Plan and Indoor Air Quality Plan.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
- B. Payment Application Times: Submit Application for Payment to the Owner by the 25th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 - 1. Submit draft copy of Application for Payment (7) days prior to due date for review by Architect.

- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
 - 1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. The Owner 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 for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
 - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit (3) signed and notarized original copies of each Application for Payment to the Owner by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 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. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Sustainable design action plans, including preliminary project materials cost data.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Division 01 Section "Closeout Procedures."
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
 3. Administrative actions and/or submittals that shall precede or coincide with this application include:
 - a. Occupancy permits and similar approvals.
 - b. Warranties (guarantees) and maintenance agreements.
 - c. Test/adjust/balance records.
 - d. Maintenance instructions.
 - e. Startup performance reports.
 - f. Changeover information related to Owner's occupancy, use, operation, and maintenance.
 - g. Final cleaning.
 - h. Application for reduction of retainage and consent of surety.
 - i. Advice on shifting insurance coverages.
 - j. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Completion of Commissioning items.
4. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
5. Updated final statement, accounting for final changes to the Contract Sum.
6. AIA Document G706.
7. AIA Document G706A.
8. AIA Document G707.
9. Evidence that claims have been settled.
10. 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.
11. Final liquidated damages settlement statement.
12. Proof that taxes, fees, and similar obligations are paid.
13. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. RFIs.
 - 4. Digital project management procedures.
 - 5. Project meetings.
- B. Related Requirements:
 - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Within (5) Days of receipt of Notice to Proceed, prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address 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.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in temporary field office. Keep list current at all times.

1.5 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.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated 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. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative 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. Supplement plan drawings with section drawings where required to adequately represent the Work.
 2. Plenum Space: Indicate subframing for support of ceiling, and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 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. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.

- b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
 - 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
 - 9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
- C. Coordination Drawing Process: Prepare coordination drawings in the following manner:
- 1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
 - 2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
 - 3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
 - 4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
 - 5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.
 - 6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
 - 7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

1.7 REQUEST FOR INFORMATION (RFI)

- A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
- 1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
 - 2. Coordinate and submit RFIs in a prompt manner 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. Owner name.

3. Owner's Project number.
 4. Name of Architect.
 5. Architect's Project number.
 6. Date.
 7. Name of Contractor.
 8. RFI number, numbered sequentially.
 9. RFI subject.
 10. Specification Section number and title and related paragraphs, as appropriate.
 11. Drawing number and detail references, as appropriate.
 12. Field dimensions and conditions, as appropriate.
 13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 14. Contractor's signature.
 15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in PDF format.
- D. Architect's Action: Allow (5) 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 Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 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 by Architect 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 Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Owner in writing within [3] days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number.

- 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 (3) days if Contractor disagrees with response.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. PDF Document Preparation: PDFs are required to be submitted to Architect, prepare 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. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: Contractor will 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 a minimum of seven days prior to meeting.
 - 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 (5) days of the meeting.
- B. Preconstruction Conference: Owner will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
 - 1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, 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. Responsibilities and personnel assignments.
 - b. Tentative construction schedule.
 - c. Phasing, if applicable.
 - d. Critical work sequencing and long lead items.
 - e. Designation of key personnel and their duties.
 - f. Lines of communications.
 - g. Procedures for processing field decisions and Change Orders.
 - h. Procedures for RFIs.
 - i. Procedures for testing and inspecting.
 - j. Procedures for processing Applications for Payment.
 - k. Distribution of the Contract Documents.
 - l. Submittal procedures.
 - m. Preparation of Record Documents.

- n. Use of the premises.
 - o. Work restrictions.
 - p. Working hours.
 - q. Owner's occupancy requirements.
 - r. Responsibility for temporary facilities and controls.
 - s. Procedures for moisture and mold control.
 - t. Procedures for disruptions and shutdowns.
 - u. Construction waste management and recycling.
 - v. Parking availability.
 - w. Office, work, and storage areas.
 - x. Equipment deliveries and priorities.
 - y. First aid.
 - z. Security.
 - aa. 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 when required by other Sections and when required for 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, and Owner's Commissioning Authority 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 requirements.
 - 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. Project Closeout Conference: Contractor will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than (90) days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for completing sustainable design documentation.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. Preparation of Contractor's punch list.
 - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - j. Submittal procedures.
 - k. Owner's partial occupancy requirements.
 - l. Installation of Owner's furniture, fixtures, and equipment.
 - m. Responsibility for removing temporary facilities and controls.
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Contractor will conduct progress meetings at biweekly intervals.
- 1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, 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) Resolution of BIM component conflicts.
 - 4) Status of submittals.
 - 5) Status of sustainable design documentation.
 - 6) Deliveries.
 - 7) Off-site fabrication.
 - 8) Access.
 - 9) Site use.
 - 10) Temporary facilities and controls.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.
 - 16) Status of Proposal Requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) 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 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.
- B. Related Requirements:
 - 1. Division 01 Section "Quality Requirements" for schedule of tests and inspections.
 - 2. Division 01 Section "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.3 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. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.
- C. 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 the critical path of Project and when activities can be performed.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

- E. Event: The starting or ending point of an activity.
- F. 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.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file.
 - 2. PDF file.
- B. Startup construction schedule.
 - 1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, 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 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 each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
 - 3. Total Float Report: List of activities sorted in ascending order of total float.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.

- H. Material Location Reports: Submit at weekly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Unusual Event Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's Construction Schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including phasing work stages area separations and interim milestones.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 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.

1.7 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

- B. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting, using CPM scheduling.
 - 1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- D. Activities: Treat each floor 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. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Construction of mock-ups, prototypes and samples.
 - d. Owner interfaces and furnishing of items.
 - e. Interfaces with Separate Contracts.
 - f. Regulatory agency approvals.
 - g. Punch list.
 - 3. Procurement Activities: Include procurement process activities for the following long lead-time 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.
 - 4. 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.
 - 5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
 - 6. 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.
 - 7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
- E. 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. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Uninterruptible services.
 - c. Partial occupancy before Substantial Completion.
 - d. Use-of-premises restrictions.

- e. Provisions for future construction.
 - f. Seasonal variations.
 - g. Environmental control.
- 2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
- F. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:
 - 1. Temporary enclosure and space conditioning.
- G. 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 the Contract Time.
- H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
 - 1. Revise 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.
- I. 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. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

- J. 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.

1.8 STARTUP CONSTRUCTION SCHEDULE

- A. Baseline Schedule: Within thirty (30) Days after the Award of the Contract, the Contractor shall submit to the Department a detailed baseline schedule indicating the time allocated by the Contractor for performance of each portion of the Work. The baseline schedule shall show commencement of Work from the date the Notice to Proceed is issued. The baseline schedule shall show Full and Final Completion of the Work within the Contract Time as specified in the Contract or as mutually agreed upon with the County in writing pursuant to a Contract Modification after execution of the Contract.

1.9 CPM SCHEDULE REQUIREMENTS

- A. Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's Construction Schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule, so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule to coordinate with the Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.

- d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Punch list and Final Completion.
 - k. Activities occurring following Final Completion.
2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, sustainable design documentation, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
 - b. Total cost assigned to activities shall equal the total Contract Sum.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
 - a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.

1.10 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. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.
12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on

and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. 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.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

SECTION 01 32 33 - 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.
 - 3. Final Completion construction photographs.
- B. Related Requirements:
 - 1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

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 image files within five (5) days of taking photographs.
 - 1. Submit photos on thumb drive. Include copy of key plan indicating each photograph's location and direction.
 - 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. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.3 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1.4 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs with maximum depth of field and in focus.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Preconstruction Photographs: Before commencement of the Work, take photographs of Project structures and surrounding site, 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 before starting the Work to accurately record physical conditions at start of construction.
 - 3. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- D. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- E. Periodic Construction Photographs: Take 20 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Division 01 Section "Project Management and Coordination" for submitting coordination drawings and subcontract lists.
 - 3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Division 01 Section "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 5. Division 01 Section "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 6. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 7. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 8. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- 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. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list 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. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal Category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled dates for purchasing.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.5 SUBMITTAL FORMAT

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.
 10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.
 16. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.

- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF files.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
- 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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow (15) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow (15) days for review of each resubmittal.
 - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow (21) days for initial review of each submittal.
- D. 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.
- E. 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.
- F. 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.

1.7 SUBMITTAL REQUIREMENTS

- A. 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 unsuitable 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 that show 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 Shop Drawings, and before or concurrently with Samples.
- B. 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.

- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
 4. 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.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

- 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. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
- E. 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.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
1. Certificates and Certifications Submittals: Submit 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. Provide a notarized signature where indicated.
 2. 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.
 3. 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.
 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
1. 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 substrate preparation and primers required.
 2. 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.
 3. 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.
 4. 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.
5. 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.
 6. 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. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 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 insufficient 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 file 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.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals 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. Contractor's Approval: Indicate Contractor's approval for each submittal. Include 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.
 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Contractor will preview all submittals, verify compliance, and then submit to Architect for review. Incomplete submittals will be returned to Contractor.
- B. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate 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. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Architect will return without review submittals received from sources other than Contractor.
- G. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

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 quality assurance and quality control.
- B. Testing and inspection 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. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Requirements:
 - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 2. Division 01 Section "Execution" for Contract Document requirements for cutting and patching.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, 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.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. 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, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).
 - D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
 1. Mockups are used for one or more of the following:
 - a. Verify selections made under Sample submittals.
 - b. Demonstrate aesthetic effects.
 - c. Demonstrate the qualities of products and workmanship.
 - d. Demonstrate successful installation of interfaces between components and systems.
 - e. Perform preconstruction testing to determine system performance.
 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
 - E. 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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
 - F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
 - G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
 - H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."
 - I. 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.
 - J. 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. Contractor's quality-control services do not include contract administration activities performed by Architect.
- 1.4 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 Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is 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.

1.6 ACTION SUBMITTALS

- A. Mockup Shop Drawings:
 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 2. Indicate manufacturer and model number of individual components.
 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. 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.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 1. Specification Section number and title.
 2. Entity responsible for performing tests and inspections.
 3. Description of test and inspection.
 4. Identification of applicable standards.

5. Identification of test and inspection methods.
 6. Number of tests and inspections required.
 7. Time schedule or time span for tests and inspections.
 8. Requirements for obtaining samples.
 9. Unique characteristics of each quality-control service.
- E. Reports: Prepare and submit certified written reports and documents as specified.
- F. Permits, Licenses, and Certificates: For Owner's record, 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.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: The Contractor will manage the Quality-Control Process. Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect and Owner. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 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, telephone number, and email address 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 inspection.
 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 Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

- A. 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- 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, applying, 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 is similar in material, design, and extent to those indicated for this Project.
- F. **Specialists:** Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.
 - 1. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. **Testing and Inspecting Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. **Manufacturer's Technical 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. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. **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 Contractor's responsibilities, including the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - 4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
 - 5. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.

6. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, 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.
- K. 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 of size indicated.
 2. Build in-situ mockups or, if not indicated, as directed by Architect.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 6. Obtain Architect's and Owner's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 10. Demolish and remove mockups when directed unless otherwise indicated.

1.11 QUALITY CONTROL

- A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

- B. 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.
- C. 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 locations 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 duties of Contractor.
- D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- F. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
 - 1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
 - 2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Contractor will engage a qualified independent testing agency to conduct special tests and inspections required by authorities having jurisdiction, and as follows:
 - 1. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 2. 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.
 - 3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 4. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
 - 5. 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, Commissioning Authority's, and authorities' having jurisdiction reference during normal working hours.
 - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, 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 Division 01 Section "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 01 40 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect unless specifically noted otherwise. The Owner will not accept a Contractor's cost or use charges for temporary services or facilities as a basis of claim for an adjustment in the Contract Sum or the Contract Time
 - 1. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Water Service: The Contractor will pay water service use charges for all metered water used by all entities engaged in construction activities at the Project Site.
- C. Electric Power Service: The Contractor will pay electric power service use charges for all metered electric power used by all entities engaged in construction activities at the Project Site.
- D. Fuel for Temporary Heat: As described in the Temporary Heat paragraph.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.
- C. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:

1. Methods used to meet the goals and requirements of the Owner.
 2. Concrete cutting method(s) to be used.
 3. Location of construction devices on the site.
 4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
 5. Indicate activities that may disturb adjacent building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
- D. Vibration Monitoring Surveys: Refer to Paragraph 3.6 for requirements of pre-demolition and post-demolition surveys.

1.5 QUALITY ASSURANCE

- A. Regulations: Contractor shall comply with industry standards and with applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
1. Building code requirements.
 2. Health and safety regulations.
 3. Utility company regulations.
 4. Police, fire department and rescue squad rules.
 5. Environmental protection regulations.
- B. Standards: Contractor shall comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with the normal application of trade regulations and union jurisdictions.
 2. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

- A. Temporary Utilities: The Contractor shall prepare a schedule indicating dates for implementation and termination of each temporary utility for which the Contractor is responsible. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
1. Temporary Use of Permanent Facilities: The Installer of each permanent service shall assume responsibility for its operation, maintenance, and protection during use as a construction facility prior to the Owner's acceptance, regardless of previously assigned responsibilities. The Contractor shall make permanent facilities available in accordance with the approved Project Schedule.
 2. Warranty Period: The Warranty Period for the entire project shall begin on the date of Substantial Completion regardless of the start-up date for use as a temporary or permanent facility, including but not limited to materials and equipment.

- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lumber and Plywood: Comply with the requirements of Division 06 Section "Rough Carpentry."
- B. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- C. Temporary Fencing: By Contractor
- D. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.
- E. Filter media installed during construction and prior to occupancy: Minimum MERV 8 or F5 filter class.

2.2 EQUIPMENT

- A. Water Hoses: Provide 3/4-inch heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- B. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher voltage outlets. Provide 120-V, single phase, receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- C. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- D. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. At a minimum, install weather-proof sockets complete with 100 watt lamps at 20' on center in all corridor areas, circulation areas and all spaces over 400 square feet. Provide guard cages or tempered-glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- E. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

- F. 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, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with minimum MERV 8 or F5 filter class at each return-air grille in system and remove at end of construction and clean HVAC system as required in Division 01 Section "Closeout Procedures."

2.3 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Contractor to provide field office for Architect.
 - 1. Job Meetings to occur in Contractors field office location to be determined.
- C. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

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

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - 1. Sterilization: Sterilize temporary water piping prior to use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 - 1. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 V, ac 20 ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Lighting: When an overhead floor or roof deck has been installed, 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 the entire system.
- E. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations, or protection of 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. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
 - 1. Provide temporary heat at varying stages of the Project to allow construction operations to proceed in an orderly, sequential manner. The following stages are milestones that must be clearly identified on the CPM Schedule as described in Division 1 Section "Construction Progress Documentation." The stages of the project are defined as follows:
 - a. Early Stage: The duration of the project from the start of construction to enclosure of the building. During this stage, the Contractor is responsible to provide temporary heat and any temporary enclosure to contain the heated air necessary for its own construction activities. The Contractor is responsible to furnish the equipment and fuel for their own temporary heating.
 - b. Intermediate Stage: The duration of the project from the time the building is wholly or partially enclosed as determined by the Architect but prior to the operation of the permanent HVAC equipment for construction heating. During this stage, the Contractor shall provide temporary heating to establish an ambient air temperature in the building, or portion thereof, to maintain construction activities, including the provision of necessary equipment and fuel. An ambient air temperature of 50 degrees F must be capable of being maintained throughout the area of work receiving temporary heat.

- c. Final Stage: The duration of the project after building enclosure is attained and the permanent HVAC equipment is available to provide temporary heat and air conditioning as determined by the Architect. An ambient air temperature of 70 degrees F must be capable of being maintained uniformly. The Contractor is responsible to provide start-up, maintenance and operation of all permanent HVAC units and provide temporary automatic temperature control wiring and devices to properly regulate the permanent devices. The Contractor is responsible to have all permanent HVAC units that will provide temporary heat wired with their required power with service disconnects and all other NEC requirements. If power cannot be provided using the permanent electrical panel, wiring or distribution, then the Contractor must provide temporary means to meet the needs of the units.
 2. Temporary heat shall be initiated and maintained to allow the performance of work for which a particular minimum ambient temperature must be maintained to meet the criteria described in individual sections of the technical specifications and as set forth by manufacturers recommendations.
 3. Temporary heat shall be provided to ensure that construction activities conform with the construction schedule and to the scheduling sequence established by the Contractor and as further directed by the Architect.
 4. The term "building enclosure" refers to a level of completion of the building, or a designated portion thereof that consists of the following:
 - a. Construction of roof structure, roof, insulation and roofing membrane.
 - b. Construction of back-up masonry or exterior metal studs with exterior sheathing.
 - c. Temporary enclosure of exterior wall openings. Refer to the "Temporary Enclosures" paragraph below for additional information.
 5. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Heating Facilities: Except where use of the permanent system is authorized, provide properly vented self-contained LP gas or fuel oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, or open burning or salamander type heating units is prohibited.
- G. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Provide separate facilities for male and female personnel.
- H. Electronic Communication Service: Contractor to provide secure Wi-Fi wireless connection to internet with provisions for access by Architect and Owner only.
1. Subcontractors to provide own accommodations.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Storage and Fabrication Facilities: Install storage and fabrication sheds or mobile trailers, sized, furnished and equipped to accommodate materials and equipment involved. Facilities may be open shelters or fully enclosed.
- B. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
 - 1. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.
- C. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply.
- D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water, ice, and snow.
 - 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.
- E. Project Signs: Contractor to provide project signs.
- F. Waste Disposal Facilities: Comply with requirements specified in Division 01 Section "Construction and Demolition Waste Management and Disposal."
- 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 Division 01 Section "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.
- I. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- J. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.5 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.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- 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.
 1. Avoid using tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.
- C. 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.
- D. 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.
- E. Rodent and 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 materials approved by authorities having jurisdiction.
- F. Site Enclosure Fence: Contractor to provide site enclosure fence.
- G. 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 workday.
 1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- J. Covered Walkways: Contractor to provide covered walkways.
- 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 heat is needed and the permanent building enclosure is not complete, provide temporary insulated enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.

2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
- L. 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. Comply with additional limits on smoking specified in other Sections.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: 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. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: 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. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

- a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
- b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
- c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Division 01 Section "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Division 01 Section "Substitution Procedures" for requests for substitutions.
 - 3. Division 01 Section "Closeout Procedures" for submitting warranties.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, 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 single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.
 - 1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the

significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Division 01 Section "Submittal Procedures."
- F. Substitution: Refer to Division 01 Section "Substitution Procedures" for definition and limitations on substitutions.

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.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 - 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 - 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with 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 that products are undamaged and properly protected.
- C. Storage:
 1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
 2. Store products to allow for inspection and measurement of quantity or counting of units.
 3. Store materials in a manner that will not endanger Project structure.
 4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
 5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 7. Protect stored products from damage and liquids from freezing.
 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to 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 in the Project Manual, prepare a written document, using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "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 meeting 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.
 6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.
- B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

- a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: 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.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: 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.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. 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 may additionally 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.

- a. For approval of products by unnamed manufacturers, comply with requirements in Division 01 Section "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "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 Division 01 Section "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 a 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 of Comparable Products: 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 the following requirements:
 - 1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 - 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.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Division 01 Section "Submittal Procedures."
 - 1. Form of Approval of Submittal: As specified in Division 01 Section "Submittal Procedures."
 - 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

HOLT PARK BUILDING IMPROVEMENTS
BALTIMORE COUNTY, MARYLAND
CONTRACT NUMBER – 25054 GX0
JOB ORDER NUMBER – 0000971385

PROJECT MANUAL
100% CONSTRUCTION DOCUMENTS

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

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 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's portion of the Work.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Division 01 Section "Summary" for coordination of Owner-furnished products and limits on use of Project site.
 - 2. Division 01 Section "Submittal Procedures" for submitting surveys.
 - 3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Division 02 Section "Structure Demolition" for demolition and removal of the building.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Certified Surveys: Submit (3) copies signed by professional engineer.

- C. Certificates: Submit certificate signed by professional engineer, certifying that location and elevation of improvements comply with requirements.

1.5 QUALITY ASSURANCE

- A. 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 is similar in material, design, and extent to those indicated for this Project.
- 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, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements 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. Operational elements include the following:
 - a. Primary operational systems and equipment.
 - b. Plumbing piping systems.
 - c. Mechanical systems piping and ducts.
 - d. Control systems.
 - e. Fire-detection and -alarm systems.
 - f. Electrical wiring systems.
 - g. Operating systems of special construction.
 - 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. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Sprayed fire-resistive material.
 - d. Equipment supports.
 - e. Piping, ductwork, vessels, and equipment.
 - f. Noise- and vibration-control elements and systems.
 - 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.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- 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. Use materials that are not considered hazardous.
- C. 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 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, gas service piping, 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 and Owner 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, submit a request for information to Architect in accordance with requirements in Division 01 Section "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor or professional engineer experienced in laying out the Work, using the following 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.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- 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.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- 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.

3.5 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb, and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 84 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- 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 satisfactory results as judged by Architect. 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 of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the 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 with manufacturer.
 - 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, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. 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. 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 adjacent buildings.
- F. 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.
- G. 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, as judged by Architect. 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 eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

- H. 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 COORDINATION OF OWNER'S PORTION OF THE WORK

- A. Site Access: Provide access to Project site for Owner's construction personnel.
 - 1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
 - 2. Refer to Division 01 Section "Summary" for other requirements for Owner-furnished, Contractor-installed products.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

- A. 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.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. 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: 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. Comply with waste disposal requirements in 017419 "Construction and Demolition Waste Management and Disposal."
- 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 ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Division 01 Section "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 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. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

- A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 74 19 - CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Recycling non-hazardous demolition and construction waste.
 - 2. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 02 41 19 – Selective Demolition.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.3 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 7 days of date established for the Notice to Proceed.

1.4 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.

7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.
- B. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Facilitate recycling and salvage of materials.

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.
 1. Distribute waste management plan to everyone concerned within 3 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 and recycled.
 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. Comply with requirements in Section 024119 Selective **Demolition** for salvaging demolition waste.
- B. Salvaged Items for Reuse in the Work:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
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.

C. Salvaged Items for Sale and Donation: Not permitted on Project site.

D. Salvaged Items for Owner's Use:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
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. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Owner.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until 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 as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

- A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.
- B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
- C. 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.
- D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- E. 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.
- F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
- G. 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.
- H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- I. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.
- J. 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.
- K. 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.
- L. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- M. Conduit: Reduce conduit to straight lengths and store by material and size.
- N. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

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.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, 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. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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.
- B. Related Requirements:
 - 1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Division 01 Section "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 4. Division 01 Section "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 DEFINITIONS

- A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.4 ACTION SUBMITTALS

- A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.5 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.6 MAINTENANCE MATERIAL SUBMITTALS

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

1.7 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, 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 Owner. Label with manufacturer's name and model number.
 - 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 Owner's signature for receipt of submittals.
 - 5. Submit testing, adjusting, and balancing records.
 - 6. Submit sustainable design submittals not previously submitted.
 - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 8. Submit a list of shop drawings for the entire project. List is to contain the following information: Title, description, specialty, (architectural, Structural, Mechanical, etc.), Decision (no exceptions taken, approved, approved as noted, etc.).

- 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.
 6. Advise Owner of changeover in utility services.
 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.
 10. Touch up paint 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. 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.

1.8 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Division 01 Section "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
 5. Submit Final Completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance 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 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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.9 LIST OF INCOMPLETE ITEMS

- 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, listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.10 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 1. Submit via email.
- E. 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.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- 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 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Vacuum and mop concrete.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - l. Remove labels that are not permanent.

- m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - p. Clean ducts, blowers, and coils if units were operated during construction or that display contamination with particulate matter on inspection.
 - q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - r. Clean strainers.
 - s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Division 01 Section "Construction and Demolition Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Division 01 Section "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect via email. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final 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 and Commissioning Agent will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Agent's comments. Submit copies of each corrected manual within 15 days of receipt of comments and prior to commencing demonstration and training.
- E. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. General: Submit Final Manual electronically and provide (3) paper copies to the Owner.
- B. 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: Bookmark 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.
- C. 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 paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
 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. Enclose title pages and directories in clear plastic sleeves.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

- b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: 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.
- B. 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 Architect.
 - 7. Name and contact information for Commissioning Agent.
 - 8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 - 9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

- 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. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- C. 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.
- D. 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.
- E. 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.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. 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 has 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.
- C. 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.
- D. 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.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. 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 warranties and bonds as described below.
- C. 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 and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; 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.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 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.
- E. 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.

- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. 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.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- J. 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 maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.
- C. 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 and drawing or schedule designation or identifier where applicable.
- D. 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.
- E. 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.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

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 Project Record Documents, including the following:
 - 1. Record Drawings.
 - 2. Record Samples.
 - 3. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
 - 2) Submit Record Digital Data Files.
 - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit (1) paper-copy set of marked-up record prints.
 - 2) Submit PDF electronic files of scanned record prints.
 - 3) Submit Record Digital Data Files.
 - 4) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Samples: Immediately prior to date of Substantial Completion meet with the Architect and the Owner's personnel at the site to determine which of the Samples maintained during the construction period shall be transmitted to the Owner for record purposes. Comply with the Architect's instructions for packaging, identification marking, and delivery to the Owner's Sample storage space. Dispose of other Samples in a manner specified for disposing surplus and waste materials.

1.4 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. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
 4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- 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: Same digital data software program, version, and operating system as for the original Contract Drawings.
 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.

4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Division 01 Section "Project Management and Coordination" for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 1. Record Prints: Organize record prints 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.

1.5 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic files and scanned PDF electronic files of marked-up miscellaneous record submittals.
 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.6 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

HOLT PARK BUILDING IMPROVEMENTS
BALTIMORE COUNTY, MARYLAND
CONTRACT NUMBER – 25054 GX0
JOB ORDER NUMBER – 0000971385

PROJECT MANUAL
100% CONSTRUCTION DOCUMENTS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Attendance Record: For each training module, submit list of participants and length of instruction time.

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.

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 instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 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. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. 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.

1.7 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 Division 01 Section "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.

- B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner through, with at least seven days' advance notice.
- C. 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.
- D. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of the building or structure.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary of Work" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss the condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
- C. Pre-demolition Photographs or Video: Submit before Work begins.
- D. Qualification Data: For refrigerant recovery technician.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.
- F. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Landfill Records: Indicate receipt and acceptance of hazardous waste by a landfill facility licensed to accept hazardous wastes.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

- A. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- B. Storage or sale of removed items or materials on-site is not permitted.
- C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. The owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or videos.
 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 2. Arrange to shut off indicated utilities with utility companies.
 - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 4. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.
 - a. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - b. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - c. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and

- chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Maintain fire watch during and for at least 24 hours after flame-cutting operations.
 5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.
- C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight.
1. Remove existing roofing system, roofing membrane, flashings, copings, roof accessories, roofing substrate, and structure as shown in drawings to complete the work.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

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

3.8 CLEANING

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

END OF SECTION 02 41 19

SECTION 02 81 00 – TRANSPORTATION AND REMOVAL OF HAZARDOUS MATERIALS

PART 1 - GENERAL

1.1 HAZARDOUS WASTE ABATEMENT AND DISPOSAL REGULATIONS

- A. As new and revised regulations are published by governmental authorities, they become a part of this specification at the time of their effective date. All hazardous materials abatement packaging, transport, and disposal must be performed in strict compliance with all applicable local, state, and federal regulations, latest edition. The Contractor must maintain all licenses and certifications, in accordance with these regulations, which must be current for the entire term of this agreement.

1.2 ASBESTOS ABATEMENT WORK

- A. Contractor must have an asbestos license and have certified asbestos abatement specialists. Individual workers must be trained through the contractor.

- B. Reference Standards

- 1. Federal Standards, latest editions:

- a. Occupational Safety and Health Act of 1970, Public Law 91-596 (84 Stat. 15900).
 - b. Federal Register of 18 Oct. 1972, as amended (29CFR 1910.1001).
 - c. Clean Air Act, as amended Public Law 91-604 (84 Stat. 1676).
 - d. Federal Register of 6 April 1973 (40CFR61:38FR8820).
 - e. U.S. Department of Labor, Occupational Safety and Health Administration, General Industry-Safety and Health Standards, OSHA 2206 (Revised Jan. 1976) as modified in 29 CFP K 1910 et seq. 1977.
 - f. Environmental Protection Agency Hazardous Waste Regulations and Consolidated Permit Regulation (40CFR 260-265 and 40CFR 122-125).

- 1. American National Standard Institute (ANSI):

- a. ANSI Z 9.2 – 1979 Design and Operation of Local Exhaust Systems.

- 2. Department of Health, Education and Welfare (DHEW)/National Institute for Occupational Safety and Health (NIOSH) Publications:

- a. DHEW (NIOSH Publication No. 79-127, February 1979 USPHS/NIOSH Membrane Filter Method for Evaluating Airborne Asbestos Fibers.

- 3. State of Maryland Department of Mental Hygiene Regulations:

- a. COMAR, TITLE 10, Subtitle 18, Chapter 15, Toxic Air Pollutants and COMAR, TITLE 10, Subtitle 18, Chapter 23, License to Remove or Encapsulate Asbestos.

- C. Definitions

- 1. Hazardous Material: A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated pursuant to the Hazardous Materials Transportation Act, 49 U.S.C. Appendix Section

1801 et seq. The term includes materials designated as hazardous materials under the provisions of 49 CFR 172, Sections .101 and .102 and materials which meet the defining criteria for hazard classes and divisions in 49 CFR 173. EPA designated hazardous wastes are also hazardous materials.

2. Hazardous Waste: A waste which meets criteria established in RCRA or specified by the EPA in 40 CFR 261 or which has been designated as hazardous by a RCRA authorized state program.

D. Submittals

1. Proof that the Contractor has been licensed and certified by the State of Maryland for asbestos removal. All licenses and certifications must be current.
2. Proof that employees have had instruction on the dangers of asbestos exposure, respirator use, decontamination, and OSHA regulations.
3. Written procedures for evacuation of injured workers. Aid for a seriously injured worker will not be delayed for reasons of decontamination.
4. Proof that all required permits, site location, and arrangements for transport and disposal of asbestos containing contaminated materials, supplies, and the like have been obtained.
5. A description of plans for construction of decontamination enclosure systems and for isolation of work areas in compliance with this specification and applicable regulations.

E. Posting Osha Regulations

1. The Contractor shall have at all times in his possession at his office (one copy) and in view at the job site (one copy), OSHA regulation 1910.1001, Asbestos, and Environmental Protection Agency 40 CFR part 61, Subpart B: National Emission Standards for asbestos, asbestos stripping work practices, and disposal of asbestos waste.

F. Worker's Dress & Equipment for Asbestos Removal

1. Work clothes shall consist of full body coverall, disposable head covers, boots, or sneakers, and respiratory protective equipment as required by OSHA regulations. Eye protection and hard hats should be available as appropriate.
2. Coveralls should be of a disposable paper type.
3. Respiratory protection for workers shall be provided by the Contractor as required by current OSHA regulations
4. The Contractor shall, at all times, have available for use by government representatives three (3) clean sets of safety equipment and clothing. This shall be stored in the clean room and be clearly marked FOR USE BY GOVERNMENT ONLY.

G. Decontamination

1. All workers without exception:
 - a. Will change work clothes at designated areas prior to start of day's work. Lockers or acceptable substitutes will be provided by the Contractor for street and work clothes.
 - b. Will remove all work clothes in work area prior to departure from this area. Workers should then proceed to showers. Workers will shower before lunch and at end of each day's work. Hot water, towels, soap and hygienic conditions are the responsibility of the Contractor.
 - c. Will not smoke, eat or drink once beyond the clean room at the job site. Prior to smoking, eating or drinking, workers will fully decontaminate by showering. Each

worker will then dress into a new clean disposable coverall to eat, smoke, or drink.
This new cover can be used to re-enter the work area.

- d. Will leave work footwear inside work area until completion of job.

H. Pre-Asbestos Removal Preparation

1. The Contractor will remove and dispose of all rubbish and debris from floor of work area first.
2. The Contractor shall thoroughly seal all openings and fixtures including, but not limited to, heating and ventilation ducts, doors, windows, and lighting with polyethylene taped securely in place.
3. Polyethylene sheets (6 mil minimum) will be used to cover entire floor and wall surfaces. Polyethylene sheets shall be used to cover all items left in place and not practical to move. Polyethylene shall be sealed so that it is secured in place during removal operations.
4. The Contractor shall set up a decontamination facility in an area pre-designated by the CCI, which will house the changing room, portable showers, toilets and equipment.
5. The Contractor shall notify Jerry Siewierski, Program Manager with the Department of Environmental Protection and Sustainability, 410-887-3745 three days in advance of beginning any asbestos abatement. The notification shall include the location of the project and the approximate amount of asbestos-containing material to be removed. It shall also include a statement that the abatement report will be provided to the Department when it becomes available.

I. Methods of Asbestos Removal

1. Asbestos abatement work shall not commence until arrangements have been made for disposal of waste at an acceptable site. The site must be identified prior to the start of work and must be approved by the PMDM or PAI.
2. The asbestos material will be sprayed with water containing an additive to enhance penetration. The additive or wetting agent will be 50% polyethylene-ester and 50% polyoxyethylene-ester at a concentration of 1 ounce per 5 gallons of water. A fine spray of this solution must be applied to prevent fiber disturbance preceding removal of asbestos material. The asbestos will be sufficiently saturated to prevent emission of airborne fibers in excess of exposure limits prescribed in the OSHA standards referenced in these specifications.
3. Removal of asbestos material will be done in small sections with two person teams, on staging platforms, if needed. Material will be packed into sealable plastic bags of 6 mil minimum thickness and place in labeled containers for transport. Place caution labels on containers in accordance with EPA Standards and OSHA Regulation 29 CFR 1910.1001 (g)(2).
4. Clean external surfaces of containers thoroughly by wet sponging in designated area of the work area which is part of the equipment decontamination enclosure system. Move containers to washroom, wet clean each container thoroughly, and move to holding area pending removal to uncontaminated areas. Insure that containers are removed from holding area by workers who entered from uncontaminated areas dressed in clean coveralls.
5. Remove visible accumulations of asbestos material and debris. Wet clean all surfaces within work area.
6. Remove plastic sheets from walls and floors, windows and doors.
7. Clean all surfaces in work area and any other contaminated area with water. After cleaning work area, wait 24 hours to allow for settlement of dust, and again wet clean all surfaces in work area. After completion of second cleaning operation, perform a complete visual inspection of work area to ensure that work area is dust free.

8. All polyethylene material, tape, cleaning material, and clothing will be placed in plastic lined drums, sealed and labeled as described above for asbestos waste material.
9. All equipment at facility will be cleaned of asbestos material prior to leaving work area. Any damage to equipment and other items shall be repaired to original condition at no cost to the Government.

J. Air Monitoring

1. Throughout removal and cleaning operations, air sample monitoring will be conducted to ensure that the Contractor is complying with all codes, regulations and ordinances. The method to be used is described in OSHA Standards 1919.939.
2. Air monitoring will be performed to provide the following samples (per week) during the period of asbestos removal:

<u>Areas</u>	<u>Samples</u>	<u>Min. Sample Vol.</u>
Work Area	4	60
Outside	2	120
Outside Bldg.	2	240

3. Samples will be taken after the actual removal operation has begun.
4. Baltimore County shall provide the air monitoring firm for sampling, testing and reporting.

K. Clean-Up Guarantee

1. After the second cleaning operation, the following test should be performed: A complete visual inspection should be made to insure dust free conditions, and two air samples within 48 hours after completion of all cleaning work should be taken. (Minimum volume of air sample 240 liters).
2. If non-compliance occurs, repeat cleaning and measurement until space is in compliance. Refer to 26 CFR 1910.1001, 7A.

L. Disposal Of Asbestos Material and Related Debris

1. All asbestos materials and miscellaneous debris in sealed drums will be transported to pre-designated disposal sites in accordance with guidelines and requirements to the U.S. Environmental Protection Agency and applicable State and local jurisdictions.
2. Workers unloading sealed drums and machinery operators will wear respirators when handling material at disposal site.
3. Bags may be dumped from drums into burial site. Drums may be reused; however, if a bag is broken or damaged, the entire drum shall be buried.
4. Contractor shall be responsible for all storage disposal, transportation, and removal permits (re: State or District, EPA, etc.).

M. Violations

1. If, at any time, the Contracting Officer decides that work practice is violating pertinent regulations or endangering workers, he will immediately notify in writing the on-site Contractor representative that operations will cease until corrective action is taken.

1.3 HAZARDOUS WASTE REMOVAL AND DISPOSAL

A. Certification

1. All bidders shall be Environmental Protection Agency and Maryland State certified hazardous waste haulers. A copy of the hauler's certification, which must be current, must be provided prior to the award of the contract.

B. Packing

1. The hazardous waste must be transported in suitable, Federal DOT approved, 55 gallon drum containers that shall preclude the loss of any of the material to the environment. The containers shall comply with all Federal Department of Transportation regulations. The Contractor shall provide all containers and all vermiculite packing materials. The Contractor must properly label each container with a label approved by the Federal Department of Transportation.

C. Licenses – Hazardous Waste

1. The successful bidder must submit, prior to award of contract, Maryland Certified Haulers License, Certified Licensing for all trucks proposed for participation in the hauling process, Certified Haulers Licenses for all other additional haulers and their trucks involved during the course of this agreement, and Certified Disposal Site Licenses for the disposal/destruction locations to be employed during the term of this agreement.

D. Permits And Manifesting

1. The Contractor shall be responsible for obtaining all necessary permits. All manifests required for hauling and disposal of materials must be prepared by the Contractor and are subject to review and approval by the Baltimore County Department of Environmental Protection and Sustainability (DEPS). A copy of each manifest shall be sent to the PMDM or PAI

E. Disposal

1. The disposal facility shall be an Environmental Protection Agency approved treatment and storage or disposal facility. The Contractor must supply to the County a Certificate of Disposal and Destruction and a copy of the completed manifest (signed off by all handlers of the waste) for each shipment of hazardous waste generated under this contract. No invoices shall be paid by Baltimore County until both documents have been provided by the Contractor to the Property Management Division Manager, or his authorized representative.

F. Removal

1. Pick-ups must be made within ten (10) calendar days after mobilization on site by the Contractor.

G. Placarding

- 1 Certified vehicles shall display a Hazardous Waste Transporter Vehicle Certification Sticker on the outside of the left door of the cab, either on the door immediately below the window or immediately forward of the door at approximately the same elevation. If the vehicle is a combination vehicle, the sticker shall be prominently displayed on the left side of the trailer and must not be obstructed from view by other markings, attachments, or equipment.
- 2 The vehicle operator shall compare labels and manifest to insure that the contents and quantities listed on the manifest are the same as those listed on the containers. Any discrepancies must be corrected.

H. Spills

1. In the event of a spill or loss of hazardous waste to the environment, any person engaged in the transportation of the waste shall not knowingly fail to report the incident immediately (within one hour) by phoning the Maryland Department of the Environment at

(410) 974-3512 and the Baltimore County Fire Department (410) 887-4592. The person and vehicle involved must remain at the scene and available until clearance to leave is given by the appropriate officials. A copy of the Oil/Chemical Spills emergency numbers card must be carried in the vehicle transporting hazardous waste.

1.4 HAZARDOUS WASTE – LIGHT BALLASTS PCB REMOVAL

A. General

1. Small capacitors and fluorescent light ballasts manufactured after 1978 have been labeled “NO PCB’s” by the manufacturers. Prior to 1978, small capacitors and fluorescent light ballasts were not labeled as to whether they contained PCB; therefore, all unlabeled capacitors and ballasts shall be assumed to contain PCB.
2. Hereunder, all ballasts not labeled “NO PCB’s” will be considered to contain PCB and shall be removed and incinerated of as such. The following procedures have been developed to assure proper incineration of small capacitors and fluorescent light ballasts.
Note All light ballasts that do not have “NO PCB’s” written on them, and all PCB contaminated materials are to be incinerated.

B. References

1. Code of Federal Regulations (CFR):
 - a. 29 CFR 1910, Occupational Safety and Health Act, General Industry.
 - b. 29 CFR 1926, Occupational Safety and Health Act, Construction Industry. 40 CFR 761, U.S. Environmental Protection Agency Regulations for PCB. 29 CFR 1910.120, OSHA General Industry, Hazardous Waste Operations Requirements.
2. Department of Transportation Regulations (DOT): 49 CFR Part 178.
3. State Regulations: Maryland Controlled Hazardous Substances (CHS) Regulations (COMAR 26.13.01.)

C. Contractor Responsibility

1. Compliance: The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State, and Local regulations pertaining to the protection of his workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor shall hold the government harmless for failure to comply with any applicable safety or health regulation on the part of himself, his employees, or his subcontractors.
2. Medical Review: The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State, and local regulations.

D. Preparation

1. Isolate the PCB area for the duration of the work so as to prevent unauthorized access by designating the area off limits to all but authorized personnel. Maintain a log of all persons visiting the PCB work site.
2. Post warning signs and labels as required by this contract 29, CFR 1910, 40 CFR 761, and as directed by the Baltimore County Government’s representative.

E. Work Procedure

1. General Procedures: Perform all PCB related work and comply with the general safety and health provisions in conformance with 29 CFR 19810, 29 CFR 1926, and 40 CFR, respectively. If a conflict arises, the more stringent application shall apply until a determination is made by the Baltimore County Government’s representative.
2. Coordination of Work of all Trades: Coordinate the work of all trades to assure that their work is performed in accordance with the applicable regulations and that the PCB control area remains separated from the remaining work areas.

F. Equipment

1. Equipment, including disposable protective clothing, i.e., type suits, respirator with filters NIOSH & OSHA approved to work with PCB's rubber gloves, etc. All equipment shall be used in the execution of this contract and be provided to visitors to the site. The equipment shall also comply with all applicable Federal, State and local regulations.
- G. Field Quality Control
1. Site Inspection and Stop Work Orders: While performing this work, the Contractor shall be subject to onsite inspection by agency officials or agency contracted inspection services. Work shall also be subject to inspection by OSHA and EPA inspectors and/or State building or health officials. If found to be in violation by one of these officials, the Contractor shall cease all work immediately. Until the violation is resolved, standby time required to resolve the violation shall be at the Contractor's expense.
 2. One complete set of equipment (such as respirators and disposable clothing) required for entry to the work area shall be made available within 2 hours of request by the Baltimore County Government's representative for inspection of work area. Such requests will only be made during normal working hours.
- H. Cleanup and Disposal
1. Permits and Notifications: Secure necessary permits in conjunction with PCB removal, hauling and disposition and provide timely notification of such actions, as may be required by Federal authorities. Notify the Office of the United States Environmental Protection Agency and provide copies of the notification to the Baltimore County Government's representative 10 days prior to the commencement of the work.
 2. Housekeeping: Essential parts of PCB control are housekeeping and cleanup procedures. Maintain all surfaces on the work area free of accumulation of debris to prevent further dispersion. Give meticulous attention to restricting the spread of debris, keep waste from being distributed over the general area or to other areas in the building. The blowing down of the work area with compressed air is forbidden. Post appropriate hazard warning signs. In all possible instances, workmen shall cleanup their own areas. Provide personnel in cleaning scrap and waste with personal protective clothing.
 3. Incineration of PCB Containing Materials: Collect and dispose of all PCB Ballasts and contaminated waste, rags, scrap, debris, bags, containers, equipment, and PCB contaminated clothing in properly labeled PCB disposal drums. Waste PCB containing material shall be transported to an incineration site. The Contractor will provide the Baltimore County Government's representative with a copy of all manifests and continuation sheets resulting from the incineration of the PCB containing waste. In some instances, a temporary holding area can be established upon approval by the Baltimore County Government's representative for properly packaged PCB waste.

1.5 HAZARDOUS WASTE – POLE MOUNTED TRANSFORMER PCB REMOVAL

A. References

1. Code of Federal Regulations (CFR):
 - a. 29 CFR 1910, Occupational Safety and Health Act, General Industry.
 - b. 29 CFR 1926, Occupational Safety and Health Act, Construction Industry. 40 CFR 761, U.S. Environmental Protection Agency Regulations for PCB. 29 CFR 1910.120, OSHA General Industry, Hazardous Waste Operations Requirements.
2. Department of Transportation Regulations (DOT): 49 CFR Part 178.
3. State Regulations: Maryland Controlled Hazardous Substances (CHS) Regulations (COMAR 26.13.01.)

A. Contractor Responsibility

1. Compliance: The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State, and Local regulations pertaining to the protection of his workers, visitors to the site, and persons occupying areas adjacent to the site. The Con-

tractor shall hold the government harmless for failure to comply with any applicable safety or health regulation on the part of himself, his employees, or his subcontractors.

2. Medical Review: The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State, and local regulations.

B. Equipment

1. Equipment, including disposable protective clothing, i.e., type suits, respirator with filters NIOSH & OSHA approved to work with PCB's rubber gloves, etc. All equipment shall be used in the execution of this contract and be provided to visitors to the site. The equipment shall also comply with all applicable Federal, State and local regulations.

C. Preparation

1. Isolate the PCB area for the duration of the work so as to prevent unauthorized access by designating the area off limits to all but authorized personnel. Maintain a log of all persons visiting the PCB work site.
2. Post warning signs and labels as required by this contract 29, CFR 1910, 40 CFR 761, and as directed by the Baltimore County Government's representative.

D. Work Procedure

1. General Procedures: Perform all PCB related work and comply with the general safety and health provisions in conformance with 29 CFR 1910, 29 CFR 1926, and 40 CFR, respectively. If a conflict arises, the more stringent application shall apply until a determination is made by the Baltimore County Government's representative.
2. Coordination of Work of all Trades: Coordinate the work of all trades to assure that their work is performed in accordance with the applicable regulations and that the PCB control area remains separated from the remaining work areas.

E. Transformer Removal

1. The following is a basic outline of the minimum steps that will be taken during the removal of PCB containing transformers. The procedure, plan of action, submitted for approval by the Contractor should address these points:
 - a. The Contractor shall assure that all power to the poles has been cut off.
 - b. The Contractor will prepare to dismantle each transformer and lower to the ground by wrapping 6 mil polyethylene or equivalent around the transformer and secure prior to lower from the pole.
 - c. Lower transformer to the ground in preparation of draining PCB fluids.
 - d. The PCB fluid inside transformers must be drained and containerized in accordance with COMAR 26.13.02.19.
 - e. Disposal of this material will be in accordance with COMAR. Any concentrations or fluids testing greater than 50 ppm are considered PCB containing.
 - f. Handling of this fluid must be by persons trained and certified in the 40 hour OSHA Hazardous Materials Worker Training Program.
 - g. Disposal of this material must be in accordance with COMAR 26.13.02.19.

F. Field Quality Control

1. Site Inspection and Stop Work Orders: While performing this work, the Contractor shall be subject to onsite inspection by agency officials or agency contracted inspection services. Work shall also be subject to inspection by OSHA and EPA inspectors and/or State building or health officials. If found to be in violation by one of these officials, the Contractor shall cease all work immediately. Until the violation is resolved, standby time required to resolve the violation shall be at the Contractor's expense.
2. One complete set of equipment (such as respirators and disposable clothing) required for entry to the work area shall be made available within 2 hours of request by the Baltimore County Government's representative for inspection of work area. Such requests will only be made during normal working hours.

G. Cleanup and Disposal

1. Permits and Notifications: Secure necessary permits in conjunction with PCB removal, hauling and disposition and provide timely notification of such actions, as may be required by Federal authorities. Notify the office of the United States Environmental Protection Agency and provide copies of the notification to the Baltimore County Government's representative 10 days prior to the commencement of the work.
2. Incineration of PCB Containing Materials: Collect and dispose of all PCB containers, equipment, and PCB contaminated clothing in properly labeled PCB disposal drums. Waste PCB containing material shall be transported to an incineration site. The Contractor will provide the Baltimore County Government's representative with a copy of all manifests and continuation sheets resulting from the incineration of the PCB containing waste. In some instances, a temporary holding area can be established upon approval by the Baltimore County Government's representative for properly packaged PCB waste.

1.6 LEAD ABATEMENT WORK

A. General

1. The Contractor shall assure Baltimore County that all lead-contaminated waste, scrap and debris is handled, stored, transported and disposed of in accordance with EPA, State and local regulatory agency requirements, latest editions.

B. Related Work

1. Title to Materials: Materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor, and shall be disposed of in accordance with the methods specified herein.

C. References

1. Code of Federal Regulations (CFR):
 - a. 29 CFR 1910, Occupational Safety and Health Act, General Industry.
 - b. 29 CFR 1926, Occupational Safety and Health Act, Construction Industry.
 - c. 29 CFR 1910.120, OSHA General Industry, Hazardous Waste Operations Requirements.
2. Department of Transportation Regulations (DOT): 49 CFR Part 178.
3. State Regulations: Maryland Controlled Hazardous Substances (CHS) Regulations (COMAR 26.13.01.)

D. Contractor Responsibility

1. Compliance: The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State, and Local regulations pertaining to the protection of his workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor shall hold the government harmless for failure to comply with any applicable safety or health regulation on the part of himself, his employees, or his subcontractors.
2. Medical Review: The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State, and local regulations.
3. Air quality during the demolition process shall be monitored for air-borne lead content and shall be in accordance with EPA, State and local regulations and requirements.

E. Work Procedure

1. Lead contaminated waste, scrap, and debris shall be disposed of as follows:
Lead contaminated waste, scrap, debris, bags, containers, equipment and lead- contaminated clothing, which may produce airborne concentrations of lead particles shall be stored in U.S. Department of Transportation CFR 49 Part 178 approved 200 liter (55 gallon) drums. Each drum shall be labeled to identify the type of waste as defined in CFR 49 Part 172 and the date lead-contaminated wastes were first put into the drum. The Uni-

form Hazardous Waste Manifest forms from the Federal and State agencies shall be obtained and completed. Land disposal restriction notifications shall be as required by CFR 40 Part 268. The Owner's Representative shall be notified at least 14 days prior to delivery to arrange for job site inspection of the drums and manifests. Lot deliveries of hazardous wastes shall be made as needed to ensure that drums do not remain on the work site longer than 90 calendar days from the date affixed to each drum.

The Contracting Officer will assign an area for interim storage of waste-containing drums.

2. Lead-contaminated waste shall be handled, stored, transported, and disposed of in accordance with CFR 40 Part 260, CFR 40 Part 261, CFR 40 Part 262, CFR 40 Part 263, CFR 40 Part 264, and CFR 40 Part 265, land disposal restriction notification shall be as required by CFR 40 Part 268.

F. Field Quality Control

1. Site Inspection and Stop Work Orders: While performing this work, the Contractor shall be subject to onsite inspection by agency officials or agency contracted inspection services. Work shall also be subject to inspection by OSHA and EPA inspectors and/or State building or health officials. If found to be in violation by one of these officials, the Contractor shall cease all work immediately. Until the violation is resolved, standby time required to resolve the violation shall be at the Contractor's expense.
2. One complete set of equipment (such as respirators and disposable clothing) required for entry to the work area shall be made available within 2 hours of request by the Baltimore County Government's representative for inspection of work area. Such requests will only be made during normal working hours.

G. Cleanup and Disposal

1. Permits and Notifications: Secure necessary permits in conjunction with lead contaminated materials removal, hauling and disposition and provide timely notification of such actions, as may be required by Federal authorities. Notify the Office of the United States Environmental Protection Agency and provide copies of the notification to the Baltimore County Government's representative 10 days prior to the commencement of the work.
2. Toxicity Characteristic Leaching Procedure (TCLP) Results: The results of the TCLP analysis performed during abatement shall be used to determine disposal procedures.
3. Disposal Documentation: Written evidence shall be provided that the hazardous waste treatment, storage, or disposal facility is approved for lead disposal by the EPA and State or local regulatory agencies. One copy shall be submitted of the complete manifest; signed, and dated by the initial transporter in accordance with CFR 40 part 262.
4. Payment for Hazardous Waste: Payment for disposal of hazardous waste will not be made until a signed copy of the manifest from the treatment or disposal facility certifying the amount of lead-containing materials delivered is returned and a copy is furnished to the Property Management Division Manager, or his authorized representative.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MEASURE AND PAYMENT

- A. Track loader, minimum 3 cubic yard bucket, paid for by the hour, includes operator, fuel, vital fluids, full maintenance and repair.
- B. Bulldozer, minimum 8' blade, paid for by the hour, includes operator, fuel, vital fluids, full maintenance and repair.

- C. Excavators with one (1) bucket, and grapple, and one (1) with mechanical pulverizer, minimum 70,000 lb. Capacity, paid for by the hour, includes operator, fuel, vital fluids, full maintenance and repair.
- D. Truck, single axle dump, tandem axle dump, and tractor trailer dump, paid for by the hour, one (1) hour total travel time allowed for both Contractor's yard to job site and dump to Contractor's yard, from job site to dump and dump to job site; includes operator, fuel, vital fluids, and full maintenance and repair. The PMDM or PAI, or his authorized representative, must approve the dump site to be used by the Contractor for each job.
- E. Dumping charges – paid for by the cubic yard, for construction debris/rubble landfill, concrete/blacktop reclamation operation, asbestos and asbestos contaminated material landfill, contaminated soil (by fuel) landfill.
- F. Borrowed material – paid for by the cubic yard, furnished and installed.
- G. Grounds restoration – paid for by the square foot, furnished and installed, topsoil, grass seed, straw mulch, hydroseeding with fiber mulch. The contaminated soil test is paid for by the each and includes all costs associated with the test.
- H. Backhoe, rubber tired, minimum 24" bucket, and skid steer, minimum 50HP, paid for by the hour, includes operator, fuel, vital fluids, full maintenance and repair.
- I. Excavator high reach, 70' reach, universal processor, pulverizer/shear, paid for by the hour, includes operator, fuel, vital fluids, full maintenance and repair.
- J. Mobilization, for track loader, bulldozer, excavators, backhoe, skid steer, and high reach excavator, individually paid once per job site.
- K. Capping of well by licensed well driller, paid for per well.

END OF SECTION 02 41 16

SECTION 03 10 00 – CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Openings for other work.
- C. Form accessories.
- D. Form stripping.

1.2 REFERENCE STANDARDS

- A. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute.
- B. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.
- C. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.
- D. ACI 347 – Guide to Formwork for Concrete; American Concrete Institute.
- E. ASME A17.1 – Safety Code for Elevators and Escalators; The American Society of Mechanical Engineers.

1.3 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on void form materials.
- C. Shop Drawings: Indicate pertinent dimensions, materials, bracing and arrangement of joints and ties.
 - 1. Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Shop drawings shall be signed and sealed by an engineer registered in the local jurisdiction.
 - 2. Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.
 - 3. Indicate location of all slab joint types.

1.4 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.
 - 1. Maintain one copy of standards on project site.

PART 2 - PRODUCTS

2.1 FORMWORK – GENERAL

- A. Provide concrete forms, accessories, shoring and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.
- C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.
- D. Comply with relevant portions of ACI 347, ACI 301 and ACI 318.

2.2 WOOD FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.

2.3 PREFABRICATED FORMS

- A. Preformed Steel Forms: Minimum 16 gage matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- B. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- C. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick.

2.4 FORMWORK ACCESSORIES

- A. Form Ties: Snap-off type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.
- B. Form Release Agent: Colorless mineral oil that will not stain concrete, absorb moisture, impair natural bonding of concrete finish coatings, or affect color characteristics of concrete finish coatings.
- C. Corners: Chamfered, rigid plastic or wood strip type, $\frac{3}{4}$ x $\frac{3}{4}$ inch size, maximum possible lengths.
- D. Dovetail Anchor Slot: Galvanized steel, 22 gage thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.
- E. Flashing Reglets: Galvanized steel, 22 gage thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.
- G. Waterstops: Preformed mineral colloid strips, ¾ inch thick, moisture expanding.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

- A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3 ERECTION – FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to over-stressing by construction loads.
- C. Provide chamfer strips on external corners of beams, joists, and columns.
- D. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.
- E. Coordinate this section with other sections of work that require attachment of components to formwork.
- F. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.4 APPLICATION – FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not apply release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS AND OPENINGS

- A. Provide formed openings where required for items to be embedded or passing through concrete work.
- B. Locate and set in place items that will be cast directly into concrete.

- C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- D. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
- E. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement.
- F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
- G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
 - 2. During cold weather, remove ice and snow from within forms. Do not use deicing 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.

3.7 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 117, unless more stringent tolerances are required within the contract documents.

3.8 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Division 1.
- B. Inspect erected formwork, shoring and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- C. Do not reuse wood formwork more than 3 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finished concrete surfaces scheduled for exposure to view.

- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 10 00

SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.2 REFERENCE STANDARDS

- A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.
- B. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.
- C. ACI SP-66 – ACI Detailing Manual; American Concrete Institute.
- D. ASTM A 615/A 615M – Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- E. ASTM A 1064/A 1064M – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain, Deformed, for Concrete.
- F. CRSI (DA4) – Manual of Standard Practice; Concrete Reinforcing Steel Institute.
- G. CRSI (P1) – Placing Reinforcing Bars; Concrete Reinforcing Steel Institute.

1.3 SUBMITTALS

- A. See Section 01 30 00: Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
- C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- D. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.4 QUALITY ASSURANCE

- A. Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, ACI SP-66, and ACI 318.
 - 1. Maintain one copy of each document on the project site.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
 - 1. Deformed billet-steel bars.
 - 2. Unfinished.
- B. Steel Welded Wire Reinforcement: ASTM A 1064/A 1064M, plain type.
 - 1. Flat sheets.
 - 2. Mesh Size and Wire Gage: As indicated on drawings.
- C. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gage.
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Supports and Spacers in Contact with the Ground:
 - a. Precast concrete supports with a surface area of not less than 4 in², a compressive strength equal to or greater than the specified compressive strength of the concrete being placed, and embedded tie wires for securing the reinforcement.
 - b. Chairs with plastic components and sand plates.
 - c. Spacers: Plastic.
 - 4. Provide stainless steel components for placement within 1½ inches of weathering surfaces.

2.2 FABRICATION

- A. Fabricate concrete reinforcing in accordance with CRSI (DA4) – Manual of Standard Practice.
- B. Welding of reinforcement is not permitted.
- C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
 - 1. Review location of splices with Architect.

PART 3 - EXECUTION

3.1 PLACEMENT

- A. Place, support and secure reinforcement against displacement before and during concrete placement. Do not deviate from required position.

- B. Clean reinforcement of loose rust, mill scale, earth, ice and other foreign materials that would reduce bond to concrete.
- C. Do not displace or damage vapor barrier.
- D. Accommodate placement of formed openings.
- E. Conform to structural drawings for concrete cover over reinforcement.

3.2 FIELD QUALITY CONTROL

- A. An independent inspection agency, as specified in Division 1, will inspect installed reinforcement for conformance to contract documents before placing concrete.

END OF SECTION 03 20 00

SECTION 03 30 00 – CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Floors and slabs on grade.
- B. Concrete foundation walls and building walls.
- C. Footings.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including equipment pads.

1.2 RELATED REQUIREMENTS

- A. Section 03 10 00 – Concrete Forming and Accessories.
- B. Section 03 20 00 – Concrete Reinforcing.
- C. Section 03 39 00 – Concrete Curing.
- D. Section 07 90 05 – Joint Sealers.

1.3 REFERENCE STANDARDS

- A. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute.
- B. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.
- C. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.
- D. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute.
- E. ACI 305R – Hot Weather Concreting; American Concrete Institute.
- F. ACI 306R – Cold Weather Concreting; American Concrete Institute.
- G. ACI 318 – Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute.
- H. ASTM C 33 – Standard Specification for Concrete Aggregates.
- I. ASTM C 39/C 39M – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- J. ASTM C 94/C 94M – Standard Specification for Ready-Mixed Concrete.

- K. ASTM C 150 – Standard Specification for Portland Cement.
- L. ASTM C 173/C 173M – Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- M. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete.
- N. ASTM C 494/ C 494M – Standard Specification for Chemical Admixtures for Concrete.
- O. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- P. ASTM C 881/C 881M – Standard Specification for Epoxy-Resin Base Bonding Systems for Concrete.
- Q. ASTM C 989 – Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
- R. ASTM C 1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
- S. ASTM C 1107/C 1107M – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-Shrink).
- T. ASTM C 1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.
- U. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-Extruding and Resilient Bituminous Types).
- V. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials.
- W. ASTM E 329 – Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction.
- X. IBC 2021 – International Building Code.

1.4 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's data on manufactured products showing compliance with specified requirements.
- C. Samples: Submit samples of under-slab vapor retarder to be used.
- D. Design Mixture

1. Submit for each concrete mixture.
2. Submit alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
3. Indicate amounts of mixing water to be withheld for later addition at project site.

1.5 QUALITY ASSURANCE

- A. Concrete Producer: Engage a firm with experience in producing concrete similar to that indicated for this project and within 15 percent of this project size, with a record of successful in-service performance as well as sufficient production capacity to supply concrete without delaying the work.
 1. Provide documentation that concrete producer has supplied concrete for at least 3 projects within 15 percent of project size and complexity in the last six years.
- B. Concrete Contractor: Engage a firm with experience in placing and finishing concrete similar to that indicated for this project and within 15 percent of this project size, with a record of successful in-service performance.
 1. Provide documentation that the concrete contractor has installed concrete for at least 3 projects within 15 percent of project size and complexity in the last six years.
- C. Perform work of this section in accordance with ACI 301 and ACI 318.
 1. Maintain one copy of each document on site.
- D. Follow recommendations of ACI 305R when concreting during hot weather.
- E. Follow recommendations of ACI 306R when concreting during cold weather.
- F. All form release agents and membrane curing compounds used for slabs and walls that are to be waterproofed shall be submitted to the manufacturer of hot fluid waterproofing system for compatibility review prior to application.
- G. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1.
 2. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

PART 2 - PRODUCTS

2.1 FORMWORK

- A. Comply with requirements of Section 03 10 00.

2.2 REINFORCEMENT

- A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS

- A. Cement: Acquire from the same source and use same type for entire Project.
 - 1. Portland Cement: ASTM C 150, Type 1.
 - 2. Blended Hydraulic Cement: ASTM C 595, Type IL, Portland-limestone.
- B. Fine and Coarse Aggregates: ASTM C 33.
 - 1. Acquire all aggregates for entire project from same source.
- C. Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.
- D. Fly Ash: ASTM C 618 Class F.
- E. Calcined Pozzolan: ASTM C 618 Class N.
- F. Silica Fume: ASTM C 1240.
- G. Water: Clean and not detrimental to concrete.
- H. Regional Materials: Provide cement and aggregate manufactured and of primary raw materials extracted or recovered within 500 mile radius of Project Site.

2.4 CHEMICAL ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C 260.
- C. High Range Water Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
- D. High Range Water Reducing Admixture: ASTM C 494/C 494M, Type F.
- E. Water Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.
- F. Water Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

- G. Accelerating Admixture: ASTM C 494/C 494M, Type C.
- H. Retarding Admixture: ASTM C 494/C 494M, Type B.
- I. Water Reducing Admixture: ASTM C 494/C 494M, Type A.

2.5 ACCESSORY MATERIALS

- A. Underslab Vapor Barrier / Vapor Retarder: Comply with ASTM E 1745, Class A.
 - 1. Maximum Permeance ASTM E 96: 0.018 perms (English).
 - 2. Provide standard accessories and tape for complete system.
 - 3. Acceptable Products:
 - a. Stego Wrap (15-mil) Vapor Barrier by Stego Industries LLC.
 - b. Perminator: 15 mils by W.R. Meadows, Inc.
 - c. 15 Mil Green by Reef Industries, Inc.
 - d. Vapor Block 15 by Raven Industries.
 - e. Yellow Guard 15-mil Vapor Barrier by Poly-America.
 - 4. Single ply polyethylene is prohibited.
- B. Non-Shrink Grout: ASTM C 1107/C 1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 - 1. Minimum Compressive Strength at 48 Hours: 2,400 psi.
 - 2. Minimum Compressive Strength at 28 Days: 7,000 psi.
- C. Curing Materials: Comply with requirements of Section 03 39 00.

2.6 BONDING AND JOINTING PRODUCTS

- A. Bonding Agent: Epoxy bonding system complying with ASTM C 881/C 881M and of Type required for specific application.
- B. Waterproofing Admixture Slurry: Slurry coat of Portland cement, sand, and crystalline waterproofing additive, mixed with water in proportions recommended by manufacturer to achieve waterproofing at cold joints in concrete.
 - 1. Manufacturers:
 - a. Aquafin, Inc.: www.aquafin.net.
 - b. Xypex Chemical Corporation: www.xypen.com.
 - c. Kryton International Inc: www.kryton.com.
- C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, sodium bentonite or other hydrophilic material for adhesive bonding to concrete.
 - 1. Available Products:
 - a. CETCO Waterstop-RX: Mineral Technologies Inc.
 - b. Conseal CS-231: Concrete Sealants Inc.
 - c. De Neef Swellseal Joint: GCP Applied Technologies

- d. Hydrotite CJ: Sika Corporation.
 - e. Mirastop BW: Henry Corporation.
 - f. Adeka Ultra Seal: OCM Inc.
 - g. Superstop: Tremco Construction Products Group
 - D. Joint Filler: Non-extruding, resilient asphalt impregnated fiberboard, cork or flexible foam, complying with ASTM D 1751, thickness as indicated on drawings and full depth of slab less ½ inch; tongue and groove profile.
 - E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center, ribbed steel stakes for setting.
 - 1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
 - 2. Height: To suit slab thickness.
 - F. Sealant and Primer: As specified in Section 07 90 05.
- 2.7 CONCRETE MIX DESIGN
- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
 - 1. Replace no less than 30% and no more than 50% of Portland cement in structural concrete with approved pozzolanic materials.
 - 2. Ground Granulated Blast Furnace Slag Content: Not to exceed 50% of cementitious material by weight.
 - 3. Fly Ash or Calcined Pozzolan Content: Not to exceed 25% of cementitious material by weight.
 - 4. Silica Fume Content: Not to exceed 10% of total cementitious material by weight.
 - 5. Obtain approval in advance before submitting mix containing any other pozzolanic substances.
 - B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
 - 1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
 - C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
 - D. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 28 days:
 - a. Typical Concrete: 3000 psi
 - b. Exposed Concrete: 5000 psi
 - 2. Water-Cementitious Materials Ratio: Maximum 58% by weight. Maximum 40% by weight for exterior concrete.
 - a. Interior slabs shall have a maximum water-cementitious material ratio of 50% by weight.
 - 3. Entrained air content for trowel-finished interior slabs shall not exceed 3%, determined in accordance with ASTM C 173/C 173M.

4. Entrained air content for footings shall not exceed 4.5%, determined in accordance with ASTM C 173/C 173M
5. Air Content for Exterior Exposed Concrete: Add air entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows with a tolerance of plus 1 or minus 1.5%, unless otherwise indicated.
 - a. Air Content: 6% entrained air, determined in accordance with ASTM C 173/C 173M.
6. Maximum Slump: 4 inches.
7. Maximum Aggregate Size: 1 inch.

2.8 MIXING

- A. Transit Mixers: Comply with ASTM C 94/C 94M.
- B. Do not add water to concrete during delivery, at the project site or during placement except as predetermined by concrete mix, unless approved by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

- A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent, as indicated on the drawings, in accordance with the manufacturer's instructions.
- B. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- C. In locations where new concrete is doweled to existing work, drill holes in existing concrete and insert steel dowels using an epoxy adhesive approved by the Architect.
- D. Install vapor retarder under interior slabs on grade in accordance with manufacturer's instructions and ASTM E 1643.

3.3 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Place concrete for floor slabs in accordance with ACI 302.1R.
- C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

- D. Separate slabs on grade from vertical surfaces with joint filler.
- E. Place joint filler in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- F. Extend joint filler from bottom of slab to within ½ inch of finished slab surface. Conform to Section 07 90 05 for finish joint sealer requirements.
- G. Install joint devices in accordance with manufacturer's instructions.
- H. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.
- I. Install joint device anchors for expansion joint assemblies specified in Section 07 95 13. Maintain correct position to allow joint cover to be flush with floor and wall finish.
- J. Apply sealants in joint devices in accordance with Section 07 90 05.
- K. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.
- L. Place concrete continuously between predetermined expansion, control and construction joints.
- M. Do not interrupt successive placement. Do not permit cold joints to occur.
- N. Place slabs on grade with saw cut pattern indicated.
- O. Saw cut joints as soon as the concrete is firm enough not to be damaged by the cutting action. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness.

3.4 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.
- B. Unexposed Form Finish: Rub down or chip off fins or other raised areas ¼ inch or more in height.
- C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas ¼ inch or more in height. Provide finish as follows:
 - 1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

3.5 CURING AND PROTECTION

- A. Comply with requirements of Section 03 39 00.

3.6 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in

Division 1.

- B. Provide free access to concrete operations at project site and cooperate with appointed firm; inspection to occur for:
 - 1. Steel reinforcement placement.
 - 2. Anchor bolts and studs.
 - 3. Verification of use of required design mixture.
 - 4. Concrete placement, including conveying and depositing.
 - 5. Curing procedures and maintenance of curing temperature.
 - 6. Verification of concrete strength before removal of shores and forms from beams and slabs.
 - C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
 - E. Test composite samples of fresh concrete obtained according to ASTM C 172.
 - F. Compressive Strength Tests: ASTM C 39/C 39M.
 - 1. Compression Test Specimens: ASTM C31/C 31M; cast and laboratory cure five 6"x12" standard cylinder specimens or seven 4"x8" standard cylinder specimens for each composite sample.
 - 2. Test one laboratory-cured specimen at 7 days and one set of two 6"x12" or three 4"x8" specimens at 28 days. Remaining cylinders shall be held in reserve.
 - 3. Obtain test samples for every 75 cu.yd. or less of each class of concrete placed each day.
 - 4. A compressive-strength test shall be the average compressive strength from all specimens obtained from same composite sample and tested at age indicated.
 - 5. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 - G. Perform one slump test, at point of discharge for each set of test cylinders taken, following procedures of ASTM C 143/C 143M.
 - H. Perform air content test for each set of test cylinders taken, following procedures of ASTM C 231.
 - I. Test concrete temperature each hour when air temperature is 40 degrees F and below and when 80 degrees F and above, and for each set of test cylinders taken, following procedures of ASTM C 1064/C 1064M.
- 3.7 DEFECTIVE CONCRETE
- A. Test Results: The testing agency shall report test results in writing to the Architect and Contractor within 24 hours of test.
 - 1. Testing and inspecting agency will make additional tests of concrete when test results

- indicate that slump, compressive strengths, or other requirements have not been met, as directed by the Architect.
2. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the Architect.
 3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 4. Correct deficiencies that test reports and inspections indicate do not comply with specified requirements.
- B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements. Repair or replace defective concrete, subject to the approval of the Architect.
- C. Do not patch, fill, touch-up, repair or replace exposed concrete except upon express direction of the Architect for each individual area.

END OF SECTION 03 30 00

SECTION 03 39 00 – CONCRETE CURING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Initial and final curing of horizontal and vertical concrete surfaces.

1.2 REFERENCE STANDARDS

- A. ACI 301 – Specifications for Structural Concrete for Buildings; American Concrete Institute.
- B. ACI 302.1R – Guide for Concrete Floor and Slab Construction; American Concrete Institute.
- C. ACI 305R – Hot Weather Concreting; American Concrete Institute.
- D. ACI 306R – Cold Weather Concreting; American Concrete Institute.
- E. ACI 308R – Guide to Curing Concrete; American Concrete Institute.
- F. ASTM C 171 – Standard Specification for Sheet Materials for Curing Concrete.
- G. ASTM C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- H. ASTM D 2103 – Standard Specification for Polyethylene Film and Sheeting.

1.3 SUBMITTALS

- A. See Section 01 30 00 – Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on curing compounds, moisture-retaining sheet, and polyethylene film, including compatibility of different products and limitations.

1.4 QUALITY ASSURANCE

- A. Perform work in accordance with ACI 301 and ACI 302.1R.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Membrane Curing Compound: ASTM C 309 Type 1 – Clear or translucent, Class B.
 - 1. VOC Content not to exceed 350 g/L.

- C. Moisture-Retaining Sheet: ASTM C 171.
 - 1. Curing paper, regular.
 - 2. Polyethylene film, clear, minimum nominal thickness of 0.0040 in.
 - 3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd., 40 inches wide.
- D. Polyethylene Film: ASTM D 2103, 4 mil thick, clear.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to be cured.

3.2 EXECUTION – HORIZONTAL SURFACES

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306R for cold-weather protection and ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb./sq. ft./h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Cure floor surfaces in accordance with ACI 308.
- D. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges; maintain in place for not less than 4 days.
- E. Absorptive Moisture-Retaining Sheet: Saturate burlap-polyethylene and place burlap side down over floor slab areas, lapping ends and sides; maintain in place for 7 days.
- F. Membrane Curing Compound: Apply curing compound in accordance with manufacturer's instructions in one coat.

3.3 EXECUTION – VERTICAL SURFACES

- A. Cure surfaces in accordance with ACI 308.
- B. Membrane Curing Compound: Apply compound in accordance with manufacturer's instructions in one coat.

3.4 PROTECTION

- A. Do not permit traffic over unprotected floor surface.

END OF SECTION 03 39 00

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units (CMU).
2. Mortar and grout.
3. Reinforcement.
4. Ties and anchors.
5. Embedded flashing.
6. Accessories.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

C. Related Sections:

1. Division 05 Section "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Masonry Units: Indicate sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
4. Special Shapes: Details and installation methods incorporating special shape units.

C. Samples for Initial Selection:

1. Colored mortar for each masonry assembly in the project.

D. Samples for Verification: For each type and color of the following:

1. Pigmented and colored-aggregate mortar for each masonry assembly in the project. Make Samples using same sand and mortar ingredients to be used on Project.

2. Weep/cavity vents in color to match mortar.
3. Cavity drainage material.
4. Accessories embedded in masonry.

1.4 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type and size of product indicated. For masonry units include data on material properties, material test reports substantiating compliance with requirements.
- B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified in accordance with ASTM C1093 for testing indicated.
- B. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.
- C. Preconstruction Testing Service: Owner will a qualified independent testing agency to perform preconstruction testing on each type of unit required per test method indicated.
 1. Clay Masonry Units: ASTM C 67.
 2. Concrete Masonry Units: ASTM C 140.
 3. Mortar: For proportions per ASTM C 780.
 4. Grout: For compressive strength per ASTM C 1019.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
 1. Protect concrete masonry units from moisture absorption so that, at the time of installation, the moisture content is not more than the maximum allowed at the time of delivery.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
 - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

2. When ambient temperature exceeds 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

- A. For exposed masonry units and cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 MASONRY UNITS, GENERAL

- A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.
- C. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

- A. Regional Materials: CMUs are manufactured within 100 miles (160 km) of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.
- B. Shapes: Provide shapes indicated and as follows:
 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 2. Provide bullnose units for all interior outside corners unless otherwise indicated.
- C. CMU: ASTM C 90.
 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi for $f'_m=1500$ psi.
 2. Density Classification: Normal weight unless otherwise indicated.
 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
 4. Exposed Faces: Manufacturer's standard color and texture, unless otherwise indicated.

2.4 MORTAR AND GROUT MATERIALS

- A. Regional Materials: Manufacture aggregate for mortar and grout within 100 miles (160 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles (160 km) of Project site.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Colored Portland Cement-Lime Mix:
 - a. Eaglebond; Blue Circle Cement.
 - b. Color Mortar Blend; Glen-Gery Corporation.
 - c. Rainbow Mortamix Custom Color Cement/Lime; Holnam, Inc.
 - d. Centurion Colorbond PL; Lafarge Corporation.
 - e. Lehigh Custom Color Portland/Lime; Lehigh Portland Cement Co.
 - f. Riverton Portland Cement Lime Custom Color; Riverton Corporation (The).
 - 2. Mortar Pigments:
 - a. True Tone Mortar Colors; Davis Colors.
 - b. Centurion Pigments; Lafarge Corporation.
 - c. SGS Mortar Colors; Solomon Grind-Chem Services, Inc.
- C. Portland Cement: ASTM C150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
- D. Hydrated Lime: ASTM 207, Type S.
- E. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C150, Type I or Type III, and hydrated lime complying with ASTM C207, Type S; containing no other ingredients.
- F. Masonry Cement: ASTM C91.
- G. Aggregate for Mortar: ASTM C144.
 - 1. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color to match existing.
- H. Aggregate for Grout: ASTM C404.
- I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The); Accelguard 80.

- b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
- c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

J. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A951/A951M.
 - 1. Hot-dip galvanized, carbon steel wire for both interior and exterior walls.
 - 2. Wire Size and Side Rods: W1.7 or 0.148 inch diameter (9 gauge) unless otherwise noted.
 - 3. Wire Size and Cross Rods: W1.7 or 0.148 inch diameter (9 gauge) unless otherwise noted.
 - 4. Wire Size for Veneer Ties: W2.8 or 0.1875 inch diameter (3/16 inch).
 - 5. Spacing for Cross Rods: Not more than 16 inches on center.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods and cross rods spaced not more than 16 inches o.c. Truss type shall not be used in vertically reinforced unit masonry walls.

2.6 TIES AND ANCHORS

- A. General: Ties and anchors extend at least halfway into veneer but with at least a 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M; with ASTM A153/A153M, Class B-2 coating.
 - 2. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 zinc coating.
 - 3. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
 - 4. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
 - 1. Wire: Fabricate from 1/4-inch-diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
 - 1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch-thick, steel sheet, galvanized after fabrication.
 - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch-diameter, hot-dip galvanized steel wire.

- E. Partition Top anchors: 0.105-inch-thick metal plate with 3/8-inch-diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Joint Stabilization Anchors
 - 1. General: Provide stabilization anchors in horizontal joints of masonry units across the joint between walls at T-shape wall intersections as follows:
 - a. Use either a manufactured steel joint stabilizing anchor consisting of two steel rods, connected together on each side of masonry joint by sliding plate assemblies or 1-1/2" x 1/4" x 32" steel strap anchor with 3" (90 degree) right-angle bent ends at masonry shear walls.
 - b. Anchors to be embedded in grout-filled cores of hollow concrete masonry units.
 - c. 16" o.c. vertical spacing.
 - d. Finish: Mill galvanized or hot-dip galvanized to comply with ASTM A 153
- G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
 - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.
- H. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A307, Grade A; with ASTM A563/A563M hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A153/A153M, Class C; of dimensions indicated.

2.7 EMBEDDED FLASHING

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch (0.40 mm) thick.
 - 2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 ft. Provide splice plates at joints of formed, smooth metal flashing.
 - 3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
 - 4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
 - 5. Solder metal items at corners.
- B. Flexible Flashing: Use one of the following unless otherwise indicated:
 - 1. Stainless Steel Fabric Flashing: Composite flashing product consisting of 2 mil (0.05mm) of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric, to produce an overall thickness of 10mil (0.25mm) minimum.
 - a. Basis-of-Design Product: subject to compliance with requirements, provide York Flashings; "Multi-Flash Stainless Steel" or a comparable product by one of the following manufacturers but not limited to:
 - 1) Illinois Products, Inc.
 - 2) Prosoco, Inc.

- 3) STS Coatings, Inc.
- 4) TK Products, Inc.

C. Solder and Sealants for Sheet Metal Flashings:

- 1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
- 2. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

D. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

E. Termination Bars for Flexible Flashing: Stainless steel bars 1/8 inch by 1 inch.

2.8 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

C. Cavity Weep/Vents: Use the following unless otherwise indicated:

- 1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in colors selected from manufacturer's standard.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity to avoid being clogged by mortar droppings, thickness to match cavity air space.

- 1. Mortar deflector: strips not less than full depth of cavity thick and 16 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.

E. Proprietary Acidic Masonry 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.

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

- 1. Do not use calcium chloride in mortar or grout.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
 - 1. For masonry below grade or in contact with earth, use Type M.
 - 2. For above-grade walls, use Type S.
- D. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required.
 - 1. Pigments do not exceed 10 percent of portland cement by weight.
 - 2. Pigments do not exceed 5 percent of mortar cement by weight.
 - 3. Mix to match approved sample.
- E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
 - 1. Mix to match approved sample.
- F. Grout for Unit Masonry: Comply with ASTM C476.
 - 1. Use either pea gravel cement concrete or grout confirming to ASTM C476 with a minimum 28-day compressive strength of 3000 psi.
 - 2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
 - 2. Verify that foundations are within tolerances specified.
 - 3. Verify that reinforcing dowels are properly placed.
 - 4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Unit Masonry Assemblies shall be installed in accordance with Contract Documents, most recent technical standards published by International Masonry Institute, National Concrete Masonry Association, Brick Industry Association and the product manufacturer's printed recommendations.
- B. Thickness: Build cavity and composite walls and other masonry construction to the full thickness shown. Build single-wythe walls to the actual widths of masonry units, using units of widths indicated.
- C. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.
- D. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.
- E. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- F. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- G. No conduit or pipe shall be installed vertically or horizontally in the cavity, except for items such as wall hydrants, electrical fixtures, etc., for which penetrations shall be horizontal, perpendicular through cavity, located directly at the intended item.

3.3 TOLERANCES

- A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:
- B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, nor 1/2 inch maximum.
- D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, and reveals, do not vary from level by more than 1/4 inch in 20 feet, nor 1/2 inch maximum.
- E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
- F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed CMU Masonry: Unless otherwise indicated above, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated in structural drawings.

3.5 MORTAR BEDDING AND JOINTING

- A. Lay CMUs and hollow brick as follows:
 - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
 - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
 - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
 - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
 - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:
 - 1. Masonry Joint Reinforcement: Installed in horizontal mortar joints.
 - a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
 - b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.

- B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.
- C. Installing Cavity-Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
 - 1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 MASONRY JOINT REINFORCEMENT

- A. General: Provide continuous masonry joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
 - 3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. At all flashing locations, reinforcement shall not interrupt the flashing.

3.8 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry as follows:
 - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows:

1. Form open joint full depth of brick wythe and of width indicated; install compressible exterior expansion joint filler as per manufacturers' recommendation. Keep joint free and clear of mortar. Locations as indicated on drawings.
- D. Provide horizontal, pressure-relieving joints by inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than **3/8 inch**.
 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
 1. Prepare masonry surfaces so they are smooth and free from projections that could puncture or damage flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
 2. Extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches (203 mm); with upper edge tucked under water-resistive / air barrier, lapping at least 4 inches (102 mm). Attach to wall with termination bar.
 3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
 4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
- C. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.
- D. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.10 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
 1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

3.11 FIELD QUALITY CONTROL

A. Inspections: Special inspections in accordance with Level 2 in TMS 402.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

B. Clay Masonry Unit Test: For each type of unit provided, in accordance with ASTM C67/C67M for compressive strength.

C. Concrete Masonry Unit Test: For each type of unit provided, in accordance with ASTM C140/C140M for compressive strength.

D. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, in accordance with ASTM C780.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes.

3. Protect surfaces from contact with cleaner.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 20 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel framing angle supports for storefront window frame.
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Loose steel lintels.
- C. Related Requirements:
 - 1. Division 08 Section "Openings" for anchoring bolts for storefront window frames to existing construction.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, anchor bolts, and items with integral anchors, that are to be embedded in wood structure. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: For exterior metalwork, allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Shapes: ASTM A36/A36M.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A (ASTM F568M, Property Class 4.6); with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- D. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

2.4 FABRICATION, GENERAL

- A. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

- B. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.6 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Prime loose steel lintels located on exterior surfaces with zinc-rich primer.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with wood - inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. Anchor supports for storefront window frames securely to, and rigidly brace from, building structure.

3.3 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 05 50 00

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wood framing with dimension lumber.
 - 2. Wood boards.
 - 3. Wood blocking and nailers.
 - 4. Plywood backing panels.

1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least direction.
- C. Exposed Framing: Framing not concealed by other construction.
- D. OSB: Oriented strand board.
- E. Lumber grading agencies, and abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association
 - 2. NLGA: National Lumber Grades Authority
 - 3. SPIB: The Southern Pine Inspection Bureau
 - 4. WCLIB: West Coast Lumber Inspection Bureau
 - 5. WWPA: Western Wood Products Association

1.3 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product indicated.
 - 1. Include data for wood-preservative and fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that materials comply with requirements.
 - 2. Engineered wood products.
 - 3. Boards.
 - 4. Metal framing anchors.
 - 5. Construction adhesives.
- B. Material Certificates: For dimension lumber and boards specified to comply with minimum allowable unit stresses.
- C. Research/Evaluation Reports: For the following:
 - 1. Treated wood.
 - 2. Engineered wood products.
 - 3. Metal framing anchors.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack wood products flat with spaces beneath and between each bundle to provide air circulation. Protect wood products from the weather by covering them with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content
 - 1. Boards: 15 percent
 - 2. Dimension Lumber: 15 percent unless otherwise indicated
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
 - 1. Allowable Design Stresses: Meet or exceed those indicated per manufacturer's published values determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

- A. Preservative Treatment by Pressure Process: AWP A U1; Use Category UC3b for exterior construction not in contact with ground and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirement for untreated material.
- C. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
 - 1. Current Evaluation/Research Reports: Provide fire-retardant-treated wood for which a current model code evaluation/research report exists that is acceptable to authorities having jurisdiction and that evidences compliance of fire-retardant-treated wood for application indicated.
- B. Interior Type A: For interior locations use fire-retardant chemical formulation that produces treated lumber with the following properties under conditions present after installation.
 - 1. No reduction takes place in bending strength, stiffness, and fastener holding capacities below values published by manufacturer of chemical formulation that are based on tests by a qualified independent testing laboratory of treated wood products identical to those indicated for this Project under elevated temperature and humidity conditions simulating installed conditions.
 - 2. No other form of degradation occurs due to acid hydrolysis or other causes related to manufacture and treatment.
 - 3. No corrosion of metal fasteners results from their contact with treated wood.
- C. Inspect each piece of treated lumber after drying and discard damaged or defective pieces.
- D. Available Products: Subject to compliance with requirements, fire-retardant-treated wood products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Interior Type A Fire-Retardant-Treated Wood:
 - a. Dricon, Hickson Corporation.
 - b. Pyro-Guard, Hoover Treated Wood Products.
 - c. Flameproof LHC-HTT, Osmose Wood Preserving Co., Inc.

2.4 DIMENSION LUMBER

- A. General: Of grades indicated according to the American Lumber Standard Committee National Grading Rule provisions of the grading agency indicated.
- B. Load-Bearing Partitions by Grade: Construction or No. 2 grade
 - 1. Species:
 - a. Hem-fir (north); NLGA
 - b. Southern pine; SPIB
 - c. Douglas fir-larch; WCLIB or WWPA
 - d. Spruce-pine-fir; NLGA
- C. Ceiling Joists: Construction or No. 2 grade
 - 1. Species:
 - a. Hem-fir (north); NLGA
 - b. Southern pine; SPIB
 - c. Douglas fir-larch; WCLIB or WWPA
 - d. Spruce-pine-fir; NLGA
- D. Joists, Rafters, or Other Framing by Grade: Select Structural or No. 1 grade
 - 1. Species:

- a. Hem-fir (north); NLGA
- b. Southern pine; SPIB
- c. Douglas fir-larch; WCLIB or WWPA

- E. Exposed Framing: Hand-select material for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.
- 1. Species and Grade:
 - a. As indicated above for load-bearing construction of same type.

2.5 BOARDS

- A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:
- 1. Moisture Content: 19 percent maximum, S-DRY or KD-19.
 - 2. Where exposed finish is indicated, provide No. 1 boards per SPIC rules, Select Merchantable Boards per WCLIB rules or No. 2 Common Boards and Better per WWPA rules.
 - 3. Species: Douglas-Fir
- B. Board Sizes: Provide sizes indicated.

2.6 ENGINEERED WOOD PRODUCTS

- A. General: Provide engineered wood products for which current model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance for the application indicated with specified requirements and the building code in effect for this project.
- B. Glued laminated timbers (glulam): manufactured by end joining individual pieces of dimension lumber or boards together with structural adhesive to create long-length laminations. Long-length laminations are then face bonded together with adhesives to create the desired glulam shape.
- 1. Size: As indicated on drawings
 - 2. Species: Douglas-Fir
 - 3. Allowable design values determined according to ASTM D 3737. Allowable design stresses:
 - a. Extreme Fiber Stress in Bending (F_b): 2400 psi
 - b. Modulus of Elasticity (E): 1,800,000 psi
 - c. Shear Parallel to Grain (F_v): 265 psi
 - d. All glulam beams shall be balanced sections.

2.7 MISCELLANEOUS LUMBER

- A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
- 1. Blocking
 - 2. Nailers
 - 3. Cants
 - 4. Furring
 - 5. Grounds

- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species
- C. Concealed Boards: 19 percent maximum moisture content and of any species
- 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

2.8 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.9 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
- B. Nails, Wire, Brads and Staples: FS FF-N-105.
- C. Wood Screws: ANSI B18.6.1.
- D. Lag Bolts: ANSI B18.2.1.
- E. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.
- F. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.10 METAL FRAMING ANCHORS

- A. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
 - 1. Current Evaluation/Research Reports: Provide products for which model code evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this project.
 - 2. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.
 - 3. Products:
 - a. Simpson.
 - b. USP.

2.11 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.
- C. Fit rough carpentry to other construction, scribe and cope as required for accurate fit.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.
- E. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view of will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

3.2 WOOD FRAMING, GENERAL

- A. Framing Standard: Comply with AWC "Wood Frame Construction Manual (WFCM)", unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install framing composed of engineered wood products to comply with manufacturer's directions.
- C. Install framing members of size and spacing indicated.
- D. Anchor and nail as shown, and to comply with the following:
 - 1. Published requirements of manufacturer of metal framing anchors.
 - 2. "Recommended Nailing Schedule" of referenced framing standard and with ANSI/AWC National Design Specification (NDS) for Wood Construction with Commentary.
- E. Do not splice structural members between supports.

3.3 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Division 1. Inspections shall include, but not be limited to, wood framing and sheathing for member plumbness, alignment, location and connections.

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

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. Wall sheathing.
- 2. Roof Sheathing

- B. Related Requirements:

- 1. Division 06 Section "Rough Carpentry" for plywood backing panels.
- 2. Division 07 Section "Air Barriers" for air barrier applied over wall sheathing.
- 3. Division 07 Section "Asphalt Shingles" for roof assembly.
- 4. Division 07 Section "Fiber Cement Siding" for siding installed over wall sheathing.

1.3 PREINSTALLATION MEETINGS

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

- 1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

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 air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

- B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For the following, from ICC-ES:

1.6 QUALITY ASSURANCE

- A. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Refer to Division 07 Section "Air Barriers"

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Type and Thickness: Regular, 5/8 inch thick.
 - 2. Basis of Design: Dens Glass.
- B. Oriented-Strand-Board Sheathing, Walls: DOC PS 2, Exposure 1 sheathing.
 - 1. Thickness: Pressure Treated, 7/16 inch thick.
- C. Plywood
 - 1. Type and Thickness: Regular, 5/8 inch thick & ½" thick.

2.2 ROOF SHEATHING

- A. Exterior Grade Plywood
 - 1. Type & Thickness: Pressure Treated, 5/8 inch thick

2.3 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Screws for Fastening Gypsum Sheathing to Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Refer to Division 7 Section "Air Barriers".

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by 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. ICC-ES evaluation report for fastener.
- D. Coordinate wall installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to wood framing with nails or screws.
 - 2. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.

3.3 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 3. Termination mastic has been applied on cut edges.
 - 4. Strips and transition strips have been firmly adhered to substrate.
 - 5. Compatible materials have been used.
 - 6. Transitions at changes in direction and structural support at gaps have been provided.
 - 7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 8. All penetrations have been sealed.
- B. Air barriers will be considered defective if they do not pass tests and inspections.
- C. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- D. Prepare test and inspection reports.

END OF SECTION 06 16 00

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

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. Shop finishing of interior woodwork.
 - 2. Plastic-laminate cabinets.
 - 3. Solid-surfacing-material countertops.
 - 4. Countertop Supports.
 - 5. Metal Grommets
- B. Related Requirements:
 - 1. Division 06 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
 - 2. Division 09 Sections "Painting" and "Staining and Transparent Finishing" for field applied finishes.

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections, to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. For interior frames, discuss coordination with hardware and access control installers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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 plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.
4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples:

1. Lumber with or for transparent finish, not less than 50 sq. in. or 5 inches wide by 24 inches long, for each species and cut, finished on 1 side and 1 edge.
2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
3. Veneer-faced panel products with or for transparent finish, 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.
4. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with 1 sample applied to core material and specified edge material applied to 1 edge.
5. Solid-surfacing materials, 6 inches square.
6. Corner pieces as follows:
 - a. Miter joints for standing trim.
7. Exposed cabinet hardware and accessories, one unit for each type and finish.

D. Product Certificates: For each type of product, signed by product manufacturer.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.7 QUALITY ASSURANCE

- A. Millwork shall be manufactured in accordance with the AWI Standards in the grades hereinafter specified. In event of a dispute as to the quality grades, all parties will call upon an inspection under AWI's inspection procedures and agree to abide by the decision of AWI.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 1. Shop Certification: AWI's Quality Certification Program accredited participant.
- C. Installer Qualifications: Fabricator of products.
- D. Forest Certification: Provide wood products made from forests certified by an FSC-accredited certification body. All non-FSC wood in assemblies with FSC-certified wood shall meet the FSC Controlled Wood (CW) criteria.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Architectural Woodwork Standards, Section 2.

- B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.
- C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork 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 interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.
 - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.10 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: White Maple, Flat-cut, Clear. Grade: Custom.
- C. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

3. Particleboard: Mat-formed wood particleboard, 45 pound density, complying with AWI 200-G-2. UL approved Class 1 fire retardant treated. ASTM E 84. Thickness: $\frac{3}{4}$ ". Flame Spread: 20. Representative Product: Duraflake FR by Weyerhaeuser.
 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 5. Cleats: Veneer faced cleats at panel joints: $\frac{3}{4}$ " Medium Density Fiberboard
- D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

2.2 ARCHITECTURAL WOODWORK, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
1. The Contract Documents contain requirements that are more stringent than the Architectural Woodwork Standards. Comply with Contract Documents and Architectural Woodwork Standards.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
1. Grass America; G393.
 2. Salice; Series 200.
 3. Blum; Clip Top Press-In 71T6580
- C. Concealed hinges:
1. Hafele America Co.; A-Form hinge, 45/9.5, opening angle 175 degrees, or approved equal.
- D. Magnetic Pressure Catch and Push-in magnetic catches, BHMA A156.9, B03131:
1. Hafele America Co.; black plastic, screw-on, 245.60.307.
 2. Cabinet Pulls: Provide the following Bar Pull or approved equal:
 - a. Manufacturer: Amerock
 - b. Finish: Brushed Stainless Steel
 - c. Size: 5" x $\frac{3}{8}$ "
 - d. Number: AME 08279
- E. Catches: Roller catches, BHMA A156.9, B03071.

- F. 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.
- G. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
 - 1. Shelf Support: Hafele #282.04.711, 5mm steel nickel plated, or approved equal.

2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- D. Metal strapping:
 - 1. Provide over drywall substrate at panel joints.
 - 2. Contractor's option to use Zip-It Wall Anchors.
- E. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Wood Glues: 30 g/L.
 - 2. Contact Adhesive: 250 g/L.
- F. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.
 - 1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
 - 2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- G. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.
- H. Concealed Countertop Supports:
 - 1. Provide steel concealed brackets by A&M Hardware, Inc. or approved equal.
 - 2. Size: Coordinate with vanity detail for required supporting arm depth.
 - 3. Install bracket within stud wall construction along with wood blocking.
- I. Countertop Supports:
 - 1. Provide steel brackets by Mockett or approved equal.
 - 2. Size: Coordinate with vanity detail for required supporting arm depth.
 - 3. Supports should be spaced no more than 16" to 24" apart for optimum performance.
 - 4. Weight capacity: 400 lbs. per pair. Weight capacities valid for installation into studs or concrete only.
 - 5. Finishes: Matte Black
 - 6. Install bracket within stud wall construction along with wood blocking.

- J. Coat Hooks:
 - 1. Provide two-prong, chrome finish coat hooks by Maosifang or approved equal.

2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Custom -grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch (19 mm) Thick or Less: 1/16 inch (1.5 mm).
 - 2. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).
- D. Complete fabrication, including assembly, finishing, 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 indicated on Shop Drawings before disassembling for shipment.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, 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.
 - 1. Seal edges of openings in countertops with a coat of varnish.
- F. Fill joints or seams between plastic laminate sheets with plastic seam filler.
- G. Caulk inside joints of plastic laminate woodwork with colored caulk.
- H. Install glass to comply with applicable requirements in Division 08 Section "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.6 SHOP FINISHING

- A. Grade: Provide finishes of same grades as items to be finished.

- B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- C. General: Shop finish transparent-finished interior architectural woodwork at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing opaque-finished architectural woodwork.
- D. General: Drawings indicate items that are required to be shop finished. Finish such items at fabrication shop as specified in this Section. Refer to Division 09 painting Sections for finishing architectural woodwork not indicated to be shop finished.
- E. Shop Priming: Shop apply the prime coat including back-priming, if any, for transparent-finished items specified to be field finished. Refer to Division 09 painting Sections for material and application requirements.
- F. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
 - 1. Back-priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require back-priming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.
- G. Transparent Finish:
 - 1. Grade: Premium.
 - 2. AWI Finish System 5 (previously #TR-4) Conversion varnish.
 - 3. Flame Spread: Class A, Class 1 finish fire rating.
 - 4. Staining: Match approved sample for color.
 - 5. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
 - 6. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
 - 7. Filled Finish for Open-Grain Woods: After staining (if any), apply paste wood filler to open-grain woods and wipe off excess. Tint filler to match stained wood.
 - a. Apply wash-coat sealer after staining and before filling.
 - 8. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

2.7 PLASTIC-LAMINATE CABINETS

- A. Grade: Custom.
- B. AWI Type of Cabinet Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Edges: Grade HGS.

D. Materials for Semi-exposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
 - a. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
2. Drawer Sides and Backs: Thermoset decorative panels.
3. Drawer Bottoms: Thermoset decorative panels.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. 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.

G. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS

A. Manufacturers:

1. Corian (Basis of Design)
2. Meganite
3. Wilsonart
4. Or approved equal

B. Grade: Premium

C. Solid-Surfacing-Material Thickness: 1/2 inch with built up edges

D. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. As indicated by manufacturer's designations.

E. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.

1. Fabricate tops with loose backsplashes for field application.

F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

G. Quality Standard: Comply with AWI Section 400 and its Division 400C.

H. Schedule of Solid-Surfacing Materials:

SSM-1

Manufacturer: Corian

Color: Architect to select from manufacturer's full range

Installation: Countertop and Apron

Location: Restroom Addition – Garden Cabin, Restroom – 112 McCormick Cabin

SSM-2

Manufacturer: Corian
Color: Architect to select from manufacturer's full range
Installation: Window Sill
Location: Restroom Addition – Garden Cabin

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.
- B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. 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. Maintain veneer sequence matching of cabinets with transparent finish, for wood cabinets.

3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches(400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch(25-mm) penetration into wood framing, blocking, or hanging strips .
- H. 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 tops with concealed metal brackets at 16 inches(400 mm) o.c. and to walls with adhesive.
 4. Seal seams between plastic laminate panels and between top and backsplash with plastic seam filler.
 5. Caulk space between backsplash and wall with colored caulk.
- I. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, 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 woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 40 23

SECTION 06 73 00 – COMPOSITE DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Composite Decking
 - 2. Decking Fastening System
- B. Related Requirements:
 - 1. Division 06 Section Rough Carpentry
 - 2. Division 07 Section Air Barriers
 - 3. Division 07 Section Fiber Cement Siding

1.3 ACTION SUBMITTALS

- A. Product Data: For composite decking and decking fastening system components. Include installation instructions.
- B. Samples: For decking, not less than 24 inches (600 mm) long, showing the range of variation to be expected in appearance of decking, including surface texture.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Composite Decking
 - 2. Decking Fastening System

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials under cover and protected from weather and contact with damp or wet surfaces. Stack materials flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Handle and store decking materials to comply with manufacturer's written instructions.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of decking system that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures, including cracking, splitting, and deforming.
 - 2. Warranty Period: Twenty (20) years from date of Substantial Completion.
- B. Fade and Stain Warranty: Provide manufacturer's warranty against color fade and permanent staining within warranty period.
 - 1. Fading is defined as loss of color more than four (4) Hunter color-difference units as measured in accordance with ASTM D2244.
 - 2. Warranty Period: Twenty-five (25) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 DIMENSION LUMBER FRAMING

- A. Deck and Ramp Framing: As specified in Section 06 10 00

2.2 COMPOSITE DECKING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide AZEK Building Products; TimberTech PRO Terrain or comparable product by one of the following:
 - 1. CertainTeed Corporation
 - 2. Crawford Industries, LLC.
 - 3. Deceuninck North America
 - 4. Fiberon
 - 5. Green Bay Decking
 - 6. Midwest Manufacturing Extrusion
 - 7. Millennium Decking Inc.
 - 8. Premium Composites LLC
 - 9. Rhino Deck
 - 10. Tamko Building Products, Inc.
 - 11. Thermal Industries, Inc.
 - 12. TimeberTech
 - 13. Trex Company, Inc.
 - 14. Universal Forest Products, Inc.
 - 15. Weyerhaeuser Company
- B. Composite Decking: Solid capped four-sided shapes made from a mixture of cellulose fiber and polyethylene or polypropylene
 - 1. Decking Standard: ICC-ES AC174
 - 2. Decking Size: 0.94 by 5.36 inches
 - 3. Decking Length: 12 feet
 - 4. Configuration: Provide product with grooved edges designed for fastening with concealed decking fasteners and full profile
 - 5. Surface Texture: Embossed woodgrain

6. Color: As selected by Architect from manufacturer's full range
7. Fascia Board: 0.94 by 12 inches by 12 feet matching decking color

2.3 DECKING FASTENING SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide AZEK Building Products; CONCEALoc or comparable product by one of the following:
 1. Blue Heron Enterprises, LLC.
 2. Grabber Construction Products
 3. Ipe Clip Fastener Company Inc. (The)
 4. KK Mfg. Co., Inc.
 5. M.M. Products, Inc.
 6. Titan Metal Werks, Inc.
 7. Ty-Lan Enterprises Inc.
- B. Concealed Decking Clips: Black-oxide-coated, stainless steel clips designed to secure decking material and provide uniform spacing of decking material.
- C. Fasteners: Stainless steel screws, minimum #7 size, in sufficient length to penetrate not less than 1-1/4 inches into wood framing substrate.

2.4 ACCESSORIES

- A. Anti-Slip Strips: Provide exterior rated anti-slip strips on exterior ramp equally spaced for full length of ramp.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

- A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other constructions; scribe and cope as needed for accurate fit.
- B. Install decking in accordance with manufacturer's written instructions.
- C. Secure decking to wood framing with concealed deck clips and screws.

- D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- E. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced and with adjacent rows staggered.

END OF SECTION 06 73 00

SECTION 07 13 26 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Modified bituminous sheet waterproofing.
 - 2. Molded-sheet drainage panels.
- B. Related Requirements:
 - 1. Division 7 Section "Thermal Insulation" for insulation.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
 - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturers.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.7 WARRANTY

- A. Manufacturer's Warranty:
 - 1. Waterproofing Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - a. Warranty Period: **5** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet Waterproofing: Minimum 60-mil (nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil-thick, polyethylene-film reinforcement, and with release liner on adhesive side.
 - 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. GCP Applied Technologies (formerly W.R. Grace); Bituthene 4000.
 - b. Henry Company; Blueskin WP 100/200.
 - c. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRI 860/861.
 - d. Meadows, W. R., Inc.; SealTight Mel-Rol.
 - 2. Physical Properties:
 - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D412, Die C, modified.
 - b. Ultimate Elongation: 300 percent minimum; ASTM D412, Die C, modified.
 - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D1970/D1970M.
 - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C836/C836M.
 - e. Puncture Resistance: 40 lbf minimum; ASTM E154/E154M.

- f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D570.
 - g. Water Vapor Permeance: 0.05 perm maximum; ASTM E96/E96M, Water Method.
 - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D5385.
- 3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.3 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
 - 1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.
- B. Primer: Liquid primer recommended for substrate by sheet waterproofing material manufacturer.
- C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet waterproofing material manufacturer.
- D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.
- E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.
- F. Metal Termination Bars: Type 304 Stainless steel bars, approximately 1 by 1/8 inch, predrilled at 9-inch centers.

2.4 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel without Polymeric Film: Composite subsurface drainage panel acceptable to waterproofing manufacturer and consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft.
 - 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. Grace, W. R., & Co. - Conn.; Hydroduct 220.
 - b. Carlisle Coatings & Waterproofing Inc.; CCW MiraDRAIN 6000, CCW MiraDRAIN 6000XL, CCW MiraDRAIN 6200 or CCW MiraDRAIN 6200XL.

2.5 INSULATION

- A. Insulation: Comply with Division 07 Section "Thermal Insulation" for below grade insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
 - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
 - 2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D4263.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing applications.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections.
- E. Fill form tie holes, honeycomb, aggregate pockets, holes, and other voids.
- F. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D4258.
- G. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
- H. Corners: Prepare, prime, and treat inside and outside corners in accordance with manufacturer's instructions.
- I. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 INSTALLATION OF MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch-minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
 - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- E. Seal edges of sheet waterproofing terminations with mastic.
- F. Install sheet waterproofing and auxiliary materials to tie into adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.
- H. Immediately install drainage panels over waterproofing membrane.

3.4 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

- A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. For vertical applications, install board insulation after installing drainage panels.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests, and to furnish reports to Architect.
- B. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

3.6 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Protect installed insulation and drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 13 26

SECTION 07 21 00 – THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Glass-Fiber Blanket Insulation
 - 2. Extruded-Polystyrene (XPS) Board Insulation for underslab
 - 3. Spray polyurethane foam insulation.
- B. Related Sections:
 - 1. Division 07 Section "Asphalt Shingles" for roofing assembly.
 - 2. Division 07 Section "Vapor Retarders".

1.2 ACTION SUBMITTALS

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

1.3 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 from an applicable testing agency.

1.4 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 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, of type and minimum compressive strength indicated below.
 - 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. Owens Corning: Formular NGX Thermapink XPS
 - b. Dupont: Styrofoam Cavtymate Ultra
 - 2. Compressive Strength:
 - a. Horizontal Applications: Minimum 40-psi (Type XIV)
 - b. Vertical Applications: Minimum 25-psi (Type IV)
 - 3. Thickness: 2-inch or 2.5 inch as shown on details
 - 4. Thermal Resistance: R-10 minimum (meet R-values per drawings)
 - 5. Size: 48 by 96 inches
 - 6. Edge: Shiplap
 - 7. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84 – Class A
 - 8. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84
 - 9. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

- A. Manufactures: 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. CertainTeed Corporation
 - 2. Guardian Building Products, Inc.
 - 3. Johns Manville
 - 4. Knauf Insulation
 - 5. Owens Corning
- B. Glass-Fiber Blanket, Kraft Faced: ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier)
 - 1. Location: Exterior stud walls
 - 2. Thickness: 6 inches nominal
 - 3. R-Value: 19.0
- C. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
 - 1. Sound Attenuation Insulation: 3-1/2 inches thick, unfaced batts.

2.3 SPRAY POLYURETHANE FOAM INSULATION

- A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84 for insulating around penetrations in exterior walls.

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. BASF Corporation.
 - b. BaySystems NorthAmerica, LLC.
 - c. Dow Chemical Company (The).
 - d. ERSystems, Inc.
 - e. Gaco Western Inc.
 - f. Henry Company.
 - g. NCFI; Division of Barnhardt Mfg. Co.
 - h. SWD Urethane Company.
 - i. Volatile Free, Inc.
2. Minimum density of 1.5 lb./cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.4 INSULATION FASTENERS

- A. Fasteners: Manufacturer's standard for attachment to approved substrate.

2.5 ACCESSORIES

- A. General: As recommended by manufacturer for intended use and compatibility with other components.
- B. Insulation for Miscellaneous Voids:
 1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- C. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or 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.
- 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. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF XPS BOARD INSULATION ON BELOW GRADE WALLS

- A. Butt panels together for tight fit.
- B. Install board insulation after installing drainage panels.
- C. Adhesive Installation: Install with adhesive according to manufacturer's written instructions.

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. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. 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 (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
 - 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 interior of construction.
- D. 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 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 07 21 00

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wrap.
 - 2. Flexible flashing.

1.3 DEFINITIONS

- A. Weather Barrier: A combination of materials and accessories that do the following:
 - 1. Prevent the accumulation of water as a water-resistive barrier
 - 2. Minimize the air leakage into or out of the building envelope as a continuous air barrier
 - 3. Provide sufficient water vapor transmission to enable drying as a vapor-permeable membrane
- B. Water-Resistive Barrier: A combination of materials and accessories that prevent the accumulation of water within the wall assembly per International Building Code Section 1403.2.
- C. Continuous Air Barrier: The combination of interconnected materials, assemblies, and sealed joints and components of the building envelope that minimize air leakage into or out of the building envelope per ASHRAE 90.1 section 5.4.3.1.
- D. Vapor Diffusion: A slow movement of individual water vapor molecules from regions of higher to lower water vapor concentration (higher to lower vapor pressure).
- E. Vapor Permeable Membrane: The property of having a water-vapor permeance rating of 10 perms or greater, when tested in accordance with the desiccant method using Procedure A of ASTM E96 per definition in International Building Code. Vapor permeable material permits the passage of moisture vapor through vapor diffusion.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at the Project Site.
 - 1. Meet with Owner, Architect, Manufacturer's Certified Installer, Manufacturer's Field Representative, and installers of work that interfaces with or affects weather barrier.

2. Review methods and procedures related to weather barrier installation, including manufacturer's written instructions.
3. Review and finalize construction, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine substrate conditions and finishes for compliance with requirements.
5. Review flashings, special weather barrier details, weather barrier penetrations, and condition of other construction that affects weather barrier.
6. Review weather barrier manufacturer's Project Registration and Observation process.
7. Review Construction Indoor Air Quality Management Plan "Moisture Protection for Absorbent Materials."
8. Review temporary protection requirements for weather barrier during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. For weather barrier, include data on air and water-vapor permeance based on testing in accordance with referenced standards.
- B. Shop Drawings: Show details of weather barrier at terminations, openings, and penetrations. Show details of flexible flashing applications.
- C. Preconstruction Laboratory Mockup Testing Submittals:
 1. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 2. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.

1.6 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.
- B. Manufacturer's Instructions: For installation of each product specified.
- C. Qualification Data: For Installer and laboratory mockup testing agency.
- D. Sample Warranty: For manufacturer's warranty
- E. Reports: Field test and inspection reports.
- F. Installer's weather barrier manufacturer-training certificate.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified firm that is certified by weather barrier system manufacturer to installer manufacturer's product.

- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated.
- C. Manufacturer's Field Service: Register Project with weather barrier manufacturer prior to installation of weather barrier and comply with weather barrier manufacturer's Project registration and observation process.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Do not store near heat source or open flame.

1.9 WARRANTY

- A. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.
 - 1. Warranty Period: Ten (10) years from date of purchase.
- B. Manufacturer's Product and Labor Warranty: Manufacturer agrees to repair or replace weather barrier that fails in materials within specified warranty period, including removal and replacement of affected construction up to manufacturer's limit.
 - 1. Warranty Period: Fifteen (15) years from date of purchase.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain weather barrier assembly components from same manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures without failure due to defective manufacture of products.

2.3 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction, but not limited to the following:
 - 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. DuPont (E. I. du Pont de Nemours and Company); Tyvek CommercialWrap.

2. Water-Vapor Permeance: Not less than 50 g through 1 sq. m of surface in 24 hours per ASTM E 96/E 96M, Desiccant Method (Procedure A).
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 - PRODUCTS

3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover sheathing with water-resistive barrier as follows:
 1. Cut back barrier 1/2 inch (13 mm) on each side of the break in supporting members at expansion- or control-joint locations.
 2. Apply barrier to cover vertical flashing with a minimum 4-inch (100-mm) overlap unless otherwise indicated.
- B. Building Wrap: Comply with manufacturer's written instructions.
 1. Seal seams, edges, fasteners, and penetrations with tape.
 2. Extend into jambs of openings and seal corners with tape.

END OF SECTION 07 25 00

SECTION 07 26 00 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyimide film vapor retarders.

B. Related Requirements:

1. Division 3 Section "Cast-in-Place Concrete" for under-slab vapor barriers.
2. Division 7 Section "Thermal Insulation" for insulation products.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 VAPOR RETARDERS

- A. Sheet Retarder: Polyimide film vapor retarder for use with unfaced, vapor permeable glass fiber and mineral wool insulation in wall and ceiling cavities.

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. CertainTeed; MemBrain Continuous Air Barrier & Smart Vapor Retarder.
 - b. ProClima; Intello Plus
2. Water Vapor Permeance:
 - a. ASTM E 86, dry cup method: 1.0 perms.
 - b. ASTM E 86, wet cup method: 10.0 perms.
3. Fire Hazard Classification: ASTM E 84:
 - a. Maximum Flame Spread Index; 20.
 - b. Maximum Smoke Developed Index; 55.

2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

3.2 INSTALLATION OF VAPOR RETARDERS ON FRAMING

- A. Place vapor retarders on side of construction indicated on Drawings.
- B. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- C. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs and sealing with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Locate all joints over framing members or other solid substrates.
- D. 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.
- E. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 07 26 00

SECTION 07 27 00 - AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vapor-permeable, fluid-applied air barriers.
- B. Related Requirements:
 - 1. Division 06 Section "Sheathing" for glass-mat gypsum wall sheathing.

1.2 DEFINITIONS

- A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.
- C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier requirements and installation, special details, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 - 1. Show locations and extent of sheathing, air barrier materials, accessories, and assemblies specific to Project conditions.
 - 2. Include details for sheathing joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.
- B. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.7 CONSTRUCTION TESTING

- A. Construction Testing Service: Contractor will engage a qualified testing agency to perform construction testing.
- B. Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on testing by a qualified testing agency.
 - 1. Air-Leakage-Location Testing: Installation will be tested for evidence of air leakage according to ASTM E1186, chamber pressurization or depressurization with smoke tracers or ASTM E1186, chamber depressurization with detection liquids.
 - 2. Adhesion Testing: Installation will be tested for required air-barrier adhesion to substrate according to ASTM D4541.
 - 3. Notify Architect seven days in advance of the dates and times when testing will be conducted.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 - 1. Protect substrates from environmental conditions that affect air-barrier performance.
 - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

1.10 WARRANTY

- A. Manufacturer's Single Source Warranty: Manufacturer must warrant the material against product defect for a period of ten (10) years from date of purchase.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 FLUID-APPLIED VAPOR PERMEABLE MEMBRANE AIR BARRIER,

- A. High-Build, Vapor-Permeable Air Barrier: synthetic polymer membrane with an installed dry film thickness, in accordance with manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.
 - 1. Synthetic Polymer Standard Type: 40 deg F and higher.
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide Henry Company 'Air-Bloc 17 MR' or comparable product by one of the following:
 - 1) GCP Applied Technologies Inc. (formerly Grace Construction Products); Perm-a-Barrier VPL
 - 2) Carlisle Coatings & Waterproofing, Inc.; Fire Resist Barritech VP
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
 - b. Vapor Permeance: Minimum 5 perms; ASTM E 96/E 96M, Water Method, Procedure B.
 - c. Vapor Permeance: Record value from manufacturer; ASTM E 96/E 96M, Desiccant Method, Procedure A.
 - d. Ultimate Elongation: Minimum 200 percent; ASTM D 412, Die C.

- e. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested in accordance with ASTM D 4541.
- f. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- g. UV Resistance: Can be exposed to sunlight for 90 days in accordance with manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid primer recommended for substrate by air-barrier material manufacturer.
 - 1. Basis of design: Henry® Blueskin® Adhesive
 - a. Color: Blue
 - b. Maximum VOC: 450 g/L
 - c. Drying time (initial set): 30 minutes
 - d. Low Application Temperature: 10 degrees F (-12 degrees C)
- C. Liquid-Applied Flashing: Moisture-curing single component elastomeric liquid-applied flashing using a highly advanced Silyl-Terminated Polyether (STPE) polymer curing to a monolithic membrane; having the following typical physical properties:
 - 1. Basis of design: Henry® Air-Bloc® LF Liquid-Applied Flashing
 - a. Color: Blue
 - b. Air Permeance (ASTM E2178): Pass
 - c. Water Vapor Permeance (ASTM E96): 21.8 perms @ 25 mils
 - d. Air Leakage of Air Barrier Assemblies (ASTM E2357): Pass
 - e. Water Resistance (AC212/ASTM D2247): Pass
 - f. Nail Sealability (AAMA 711): Pass
 - g. Surface Burning Characteristics (ASTM E84):
 - 1) Flame Spread: Class A
 - 2) Smoke Development: Class A
 - h. Elongation (D412): 264%
 - i. Low Application Temperature: 20 degrees F (-7 degrees C)
- D. Self-Adhered Vapor Permeable Flashing: Self-adhered water resistive vapor permeable air barrier consisting of a reinforced modified polyolefin tri-laminate film surface and patented adhesive technology with split-back poly-release film; having the following typical physical properties:
 - 1. Basis of design: Henry® Blueskin® VP160 Self-Adhered Water Resistive Air Barrier

- a. Color: Blue
 - b. Thickness: 23 mils (0.58 mm)
 - c. Water Vapor Permeance (ASTM E96): 29 perms
 - d. Nail Sealability (ASTM D1970): Pass
 - e. Low Application Temperature: 20 degrees F (-7 degrees C)
- E. Building Envelope Sealant: Moisture cure, medium modulus polymer modified sealing compound; having the following typical physical properties:
 - 1. Basis of design: Henry® 925 BES Sealant
 - a. Color: Varies
 - b. Elongation: 450 – 550%.
- F. Termination Sealant: One-part high performance synthetic rubber sealant; having the following typical physical properties:
 - 1. Basis of design: Henry® 212 All Purpose Crystal Clear Sealant
 - a. Color: Clear
 - b. Elongation: 200% minimum

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 - 3. Verify that substrates are visibly dry and free of moisture.
 - 4. Verify that masonry joints are flush and completely filled with mortar.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply **transition strip** so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counter flashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates in accordance with the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils, applied in one or more equal coats.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.
- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air-barrier dry film thickness.

3. Continuous structural support of air-barrier system has been provided.
 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 5. Site conditions for application temperature and dryness of substrates have been maintained.
 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 7. Surfaces have been primed.
 8. Laps in sheet materials have complied with the minimum requirements and have been shingled in the correct direction (or mastic applied on exposed edges), with no fishmouths.
 9. Termination mastic has been applied on cut edges.
 10. Air barrier has been firmly adhered to substrate.
 11. Compatible materials have been used.
 12. Transitions at changes in direction and structural support at gaps have been provided.
 13. Connections between assemblies (air barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 14. All penetrations have been sealed.
- C. Air barriers will be considered defective if they do not pass tests and inspections.
1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 2. Remove and replace deficient air-barrier components for retesting as specified above.
- D. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- E. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 27 00

SECTION 07 31 13 - ASPHALT SHINGLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the materials and application procedures for the installation of asphalt shingles and underlayment materials at sloped roofs.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections
 - 1. Section 06 16 00 Sheathing
 - 2. Section 07 22 00 Roof and Deck Insulation
 - 3. Section 07 62 00 Sheet Metal Flashing and Trim

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed product and for each color and blend specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research/evaluation reports.
- C. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Fire-Resistance Characteristics: Where indicated, provide asphalt shingles and related roofing materials identical to those of assemblies tested for fire resistance per test method below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.
 - 1. Exterior Fire-Test Exposure: Class A; ASTM E 108 or UL 790, for application and roof slopes indicated.
- B. Preinstallation Conference: Conduct conference at Project site.

1.7 WARRANTY

- A. Special Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
 - 1. Material Warranty Period: 30 years from the date of Substantial Completion, prorated, with first 12 years nonprorated.
 - 2. Algae-Discoloration Warranty Period: Asphalt shingles will not discolor 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

- A. Laminated-Strip Asphalt Shingles: ASTM D 3462, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, Timberline Ultra HD® Lifetime High Definition® Shingles.
 - a. Or an equal product.
 - 2. Butt Edge: Straight cut.
 - 3. Strip Size: 13 1/4" x 39 3/8".
 - 4. Algae Resistance: Granules treated to resist algae discoloration.
 - 5. Color and Blends: As selected by Architect from manufacturer's full range.
- B. Hip, Ridge and Starter Shingles: Manufacturer's standard units to match asphalt shingles. Trim each side of lapped portion of unit to taper approximately 1 inch.

2.2 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D 226 or ASTM D4869, 30 lbs.
- B. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970, minimum of 55-mil- (1.4-mm-) thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release paper backing; cold applied.

2.3 ACCESSORIES

- A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.
- B. Roofing Nails: ASTM F 1667; aluminum, stainless-steel, copper, or hot-dip galvanized-steel wire shingle nails, minimum 0.120-inch- (3-mm-) diameter, barbed shank, sharp-pointed, with a minimum 3/8-inch- (9.5-mm-) diameter flat head and of sufficient length to penetrate 3/4 inch (19 mm) into solid wood decking or extend at least 1/8 inch (3 mm) through plywood sheathing.
 - 1. Where nails are in contact with metal flashing, use nails made from same metal as flashing.
- C. Felt Underlayment Nails: Aluminum, stainless-steel, or hot-dip galvanized-steel wire with low-profile capped heads or disc caps, 1-inch (25-mm) minimum diameter.
- D. "Starter Strip" shingles.

E. "Ridge Cap" shingles.

F. Ridge Vent

2.4 METAL FLASHING AND TRIM

A. General: Comply with requirements in Section 07 "Sheet Metal Flashing and Trim."

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.

B. Ice and Water Shield:

1. 50 ft long by 3 ft wide rolled product. Apply single layer to the top of plywood roof sheathing at the entire roof. Apply second layer at the hips, valleys and eaves of the roof. Apply second layer at penetrations through the roof. Apply to the top of plywood roof sheathing at the entire roof where roof slopes are less than 4/12.
2. Manufacturer: Grace Construction Products. Tel: 866-333-3726. Website: www.graceconstruction.com

3.2 METAL FLASHING INSTALLATION

A. General: Install metal flashings and other sheet metal to comply with requirements in Section 07620 "Sheet Metal Flashing and Trim."

1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

3.3 ASPHALT SHINGLE INSTALLATION

A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and asphalt shingle recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Install starter strip along lowest roof edge, consisting of an asphalt shingle strip at least 7 inches wide with self-sealing strip face up at roof edge.

1. Extend asphalt shingles 3/4 inch over fascia at eaves and rakes.
2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.

- E. Fasten asphalt shingle strips with a minimum of six roofing nails located according to manufacturer's written instructions.
 - 1. When ambient temperature during installation is below 50 deg F, seal asphalt shingles with asphalt roofing cement spots.
- F. Woven Valleys: Extend succeeding asphalt shingle courses from both sides of valley 12 inches beyond center of valley, weaving intersecting shingle-strip courses over each other. Use one-piece shingle strips without joints in valley.
- G. Closed-Cut Valleys: Extend asphalt shingle strips from one side of valley 12 inches beyond center of valley. Use one-piece shingle strips without joints in valley. Fasten with extra nail in upper end of shingle. Install asphalt shingle courses from other side of valley and cut back to a straight line 2 inches short of valley centerline. Trim upper concealed corners of cut-back shingle strips.
- H. Ridge and Hip Cap Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
 - 1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

END OF SECTION 07 31 13

SECTION 07 42 93 – EXTERIOR SOFFIT PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal exterior soffit panel, linear metal ceiling panel, fascia, formed metal wall panel.

1.2 RELATED SECTIONS

- A. Section 07 62 00 - Sheet Metal Flashing and Trim
- B. Section 07 92 00 - Joint Sealants

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Include trim and layout of square recessed light fixtures, GC to coordinate with electrical subcontractor.
- C. Samples: Submit duplicate 1.625 X 4 inch X 6 inch (41.28mm X 101.6mm X 150mm) samples of material, of color and profile specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 WARRANTY

- A. Provide a written guarantee, signed and issued in the name of the owner, covering the metal cladding/siding material for 15 (fifteen) years from the date of Substantial Completion. Verify available warranties and warranty periods for metal panels.
 1. Warranty Period: 15 (fifteen) years from date of Substantial Completion.

- B. The manufacturer's warranty is limited to replacement of defective material only, rather than installation of the same. Faulty installation shall be corrected by the installing contractor. The warranty required herein is the sole remedy against the manufacturer and there are no other implied warranties. In any event, the manufacturer shall not be liable for incidentals or consequential damages.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Basis of Design – PAC-CLAD Petersen Aluminum
 2. Long Board - Mayne Inc. 27575 50Ave Langley, BC Canada V3A 0A2
em.info@longboardproducts.com
ph. 1.800.604.0343
 3. Morin by Kingspan
 - a. Michael Moorhouse | CSI, LEED AP Partner + Design Consultant | Rainscreen Experto. (202) 869-3445 | m. (410) 422-6453
 4. Knotwood - Alumarch.com, 30 Technology Pkwy S, Peachtree Corners, GA 30092
<https://knotwood.com/>
 5. Or approved equal.

2.2 METAL SOFFIT PANELS

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. V-Groove-Profile Perforated panels formed with square panel edges between panels
1. Basis of Design – PAC-750 Half Vented and Solid Soffits
- C. MATERIAL
1. Aluminum panels, pre-coated by the coil-coating process to comply with ASTM A 755/ A 755M
 2. Nominal Thickness: 0.032 inch (0.86 mm)
 3. Panel Height: 1/2 inch
 4. Panel Width: 12 inches
 5. Groove Configuration: Two (2) vee-groove, fully vented
 6. Net Free Air: 6%
 7. Exterior Finish: Fluoropolymer coating applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil over 0.20 ± 0.05 mil prime coat, to provide a total top side dry film thickness of 0.95 ± 0.10 mil.
 8. Color: As selected by Architect from manufacturer's full range
 9. Surface: Smooth, flat finish
 10. Locations: See construction drawings
- D. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/180.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275) hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including J-trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal soffits.
- D. Panel Fasteners: Self-tapping concealed Stainless-Steel type 304 screws designed to withstand design loads.
- E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch (3 mm) thick.
 2. Joint Sealant: ASTM C920; as recommended in writing by metal panel manufacturer.
 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

- A. Panels and Accessories:
 - 1. Architect to select from the full line of finishes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.
 - 1. Soffit Framing: Wire tie furring channels to supports.
 - 2. Trim in field for soffit light fixtures and coordinate with light fixtures submittals.

3.2 INSTALLATION

- A. Metal Soffit Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
 - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
 - 2. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
- B. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
- C. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07 42 93

SECTION 07 46 00 – FIBER CEMENT SIDING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiber cement lap siding, panels, shingle, trim, fascia, and accessories
- B. Factory-finished fiber cement lap siding, panels, shingle, trim, fascia, and accessories

1.2 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry.
- B. Section 06 16 00 – Sheathing
- C. Section 07 21 00 – Thermal Insulation.
- D. Section 07 27 00 – Air Barriers

1.3 REFERENCES

- A. ASTM C1186 - Standard Specification for Flat Fiber-Cement Sheets.
- B. ASTM D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool, and Tape.
- C. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degrees C.

1.4 SUBMITTALS

- A. Submit under provisions of Division 01.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 4 by 6 inches (100 by 150 mm), representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Minimum of 2 years' experience with installation of similar products.
- B. Mock-Up: Provide an in-situ mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect. Notify Architect when installation is ready for inspection.
2. Do not proceed with the remaining work until workmanship, color, and sheen are approved by Architect.
3. Refinish the mock-up area as required to produce acceptable work.
4. Subject to compliance with requirements, approved mock-up may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.
- C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 PROJECT CONDITIONS

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

1.8 WARRANTY

- A. Product Warranty: Limited, non-pro-rated product warranty.
 1. Hardie Plank HZ5 lap siding for 30 years.
 2. Hardie Soffit HZ5 panels for 30 years.
- B. Product Warranty: Limited, product warranty.
 1. Hardie Trim HZ and HZ5 boards for 15 years.
- C. Finish Warranty: Limited product warranty against manufacturing finish defects.
 1. When used for its intended purpose, properly installed and maintained according to James Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.
- D. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 303 E. Wacker Dr.; Chicago, IL 60601 ; Toll Free Tel: 877-236-7526; Email:[request info \(info@jameshardie.com\)](mailto:info@jameshardie.com);
Web:<https://www.jameshardiepros.com>|<https://www.jameshardie.com>
- B. Substitutions: Approved equal product and manufacturer
- C. Requests for approval of equal substitutions will be considered in accordance with the provisions of Section 01 60 00 - Product Requirements.

2.2 SIDING

- A. Hardie Plank HZ5 lap siding and Hardie Soffit HZ5 panels requirement for Materials:
 - 1. Fiber-cement Siding - complies with ASTM C 1186 Type A Grade II.
 - 2. Fiber-cement Siding - complies with ASTM E 136 as a noncombustible material.
 - 3. Fiber-cement Siding - complies with ASTM E 84. Flame Spread Index: 0. Smoke Developed Index: 5.
 - 4. National Evaluation Report No. NER 405 (BOCA, ICBO, SBCCI, IBC, IRC).
 - 5. International Code Council Evaluation Services Report No. ESR-1844.
 - 6. International Code Council Evaluation Services Report No. ESR-2290.
 - 7. International Code Council Evaluation Services Report No. ESR-2273.
 - 8. US Department of Housing and Urban Development Materials Release 1263.
- B. Lap Siding: Hardie Plank HZ5 Lap siding with a sloped top, beveled drip edge and nailing line as manufactured by James Hardie Building Products, Inc.
 - 1. Type: Smooth 6-1/4 inches (159 mm) with 5 inches (127 mm) exposure.
- C. Soffit Panels: Hardie Soffit HZ5 Non-Vented Soffit Panel, as manufactured by James Hardie Building Products, Inc.
 - 1. Factory sealed on 5 sides.
 - 2. Thickness: 1/4 inch (6 mm).
 - 3. Type: Smooth, 12 inches (305 mm) by 12 feet (3658 mm).
- D. Vented Soffit Panels: Hardie Soffit HZ5 Vented Panels. as manufactured by James Hardie Building Products, Inc.
 - 1. Net Free Ventilation: 5 sq inches of net free ventilation per linear foot (10583 sq mm per linear meter).
 - 2. Factory sealed on 5 sides.
 - 3. Thickness: 1/4 inch (6 mm).
 - 4. Type: Smooth, 12 inches (406 mm) by 12 feet (3658 mm).
- E. Trim:
 - 1. Hardie Trim HZ5 boards and Hardie Trim HZ boards as manufactured by James Hardie Building Products, Inc.
 - 2. Hardie Trim HZ5 Fascia boards as manufactured by James Hardie Building Products, Inc.
 - 3. Hardie Trim HZ5 Crown moulding manufactured by James Hardie Building Products, Inc.
 - 4. Hardie Artisan HZ5 Accent trim as manufactured by James Hardie Building Products, Inc.

2.3 FINISHES

- A. Factory Primer: Provide factory applied universal primer.
 - 1. Primer: Factory primed by James Hardie.
 - 2. Topcoat: Refer to Section 09 90 00 - Painting and Coating and Exterior Finish Schedule.
- B. Factory Finish: Refer to Exterior Finish Schedule.
 - 1. Product: ColorPlus Technology by James Hardie.
 - 2. Definition: Factory applied finish; defined as a finish applied in the same facility and company that manufactures the siding substrate.
 - 3. Process:
 - a. Factory applied finish by fiber cement manufacturer in a controlled environment within the fiber cement manufacturer's own facility utilizing a multi-coat, heat

- cured finish within one manufacturing process.
 - b. Each finish color must have documented color match to delta E of 0.5 or better between product lines, manufacturing lots or production runs as measured by photo spectrometer and verified by third party.
- 4. Protection: Factory applied finish protection such as plastic laminate that is removed once siding is installed.
- 5. Accessories: Complete finishing system includes pre-packaged touch-up kit provided by fiber cement manufacturer. Provide quantities as recommended by Manufacturer.
- C. Factory Finish Color for Trim, Soffit and Siding Colors:
 - 1. To be selected from full range of color options.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until the substrates have been properly prepared.
- B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Nominal 2 inch by 4 inch (51 mm by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
 - 1. Install water-resistive barriers and claddings to dry surfaces.
 - 2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
 - 3. Protect siding from other trades.
- D. Minimum 20 gauge 3-5/8 inch (92 mm) C-Stud 16 inches maximum on center or 16 gauge 3-5/8 inches (92 mm) C-Stud 24 inches (610 mm) maximum on center metal framing complying with local building codes, including the use of water-resistive barriers and/or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
 - 1. Install water-resistive barriers and claddings to dry surfaces.
 - 2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
 - 3. Protect siding from other trades.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install a water-resistive barrier is required in accordance with local building code requirements.
- D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.
- E. Install Engineered for Climate Hardie Weather barrier in accordance with local building code requirements.

- F. Use Hardie Weather Barrier Seam Tape and joint and laps.
- G. Install Hardie Weather Barrier Pro- flashing, and Hardie Weather Barrier Flex Flashing.

3.3 INSTALLATION - HARDIE PLANK HZ5 LAP SIDING

- A. Install materials in strict accordance with manufacturer's installation instructions.
- B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.
- C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.
- D. Align vertical joints of the planks over framing members.
- E. Maintain clearance between siding and adjacent finished grade.
- F. Locate splices at least one stud cavity away from window and door openings.
- G. Wind Resistance: Where a specified level of wind resistance is required Hardie Plank lap siding is installed to framing members and secured with fasteners described in Table No. 2 in International Code Council Evaluation Report No. ESR-2290.
- H. Locate splices at least 12 inches (305 mm) away from window and door openings.

3.4 INSTALLATION - HARDIE SOFFIT HZ5 PANELS

- A. Install materials in strict accordance with manufacturer's installation instructions.
 - 1. Panels may be installed as soffit or ceiling over wood or steel framing; 20 gauge (33 mils) minimum to 16 gauge (54 mils), complying with local building code. Install soffits to nominal 2 x 4 inch (50 x 100 mm) framing members spaced a maximum of 24 inches (610 mm) on center with the long dimension perpendicular to the rafter or joist framing.
 - 2. Support edges by framing.
 - 3. Install water barriers and air barriers as required by local building codes.
 - 4. Ensure gutters have end caps. Maintain a minimum 1 inch (25 mm) gap between end caps and siding and trim.
 - 5. Install kickout flashing at roof-wall junctions per manufacturer's instructions.
 - 6. Additional framing may be needed to ensure proper fastening.
 - 7. Position vent holes toward outside of eave for optimal airflow.
 - 8. Vents can be installed into non-vented soffit.
 - 9. Insect screen can be installed using construction adhesive.
 - 10. Fastener Positioning: Position fasteners 3/8 inches (9.5 mm) from panel edges and no closer than 2 inches (51 mm) away from corners when using soffit greater than 12 inch (305 mm) wide and no closer than 1 inch (25 mm) away from corners when using soffit that is less than or equal to 12 inch (305 mm) wide.
 - 11. Jointing Methods: Install panels in moderate contact at ends, provide PVC or metal jointers, battens or leave appropriate gap and caulk.
 - 12. Drive fasteners perpendicular to siding and framing.
 - 13. Fastener heads should fit snug against siding; no air space.

3.5 INSTALLATION - HARDIE TRIM HZ5 BOARDS

- A. Install materials in strict accordance with manufacturer's installation instructions. Install

flashing around all wall openings.

- B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
- C. Place fasteners no closer than 3/4 inch (19 mm) and no further than 2 inches (51 mm) from side edge of trim board and no closer than 1 inch (25 mm) from end. Fasten maximum 16 inches (406 mm) on center.
- D. Maintain clearance between trim and adjacent finished grade.
- E. Trim inside corner with a single board trim both side of corner.
- F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.
- G. Allow 1/8 inch gap between trim and siding.
- H. Seal gap with high quality, paint-able caulk.
- I. Shim frieze board as required to align with corner trim.
- J. Fasten through overlapping boards. Do not nail between lap joints.
- K. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten Hardie Trim boards to Hardie Trim boards.
- L. Shim frieze board as required to align with corner trim.
- M. Install Hardie Trim Fascia boards to rafter tails or to sub fascia.

3.6 FINISHING

- A. Finish unprimed siding with a minimum one coat high quality, alkali resistant primer and one coat of either, 100 percent acrylic or latex or oil based, exterior grade topcoats or two coats high quality alkali resistant 100 percent acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.
- B. Finish factory primed siding with a minimum of one coat of high quality 100 percent acrylic or latex or oil based exterior grade paint within 180 days of installation. Follow paint manufacturer's written product recommendation and written application instructions.

3.7 PROTECTION

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

END OF SECTION 07 46 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formed roof-drainage sheet metal fabrications.
2. Formed Low-sloped sheet metal flashing.
3. Manufactured sheet metal fascia and trim.
4. Box type Gutter
5. Half Round type Gutter

B. Related Sections:

A. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 04 20 00 "Unit Masonry" for installation of manufactured sheet metal through-wall flashing and trim integral with masonry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Distinguish between shop- and field-assembled work.
3. Include identification of finish for each item.
4. Include pattern of seams and details of termination points, expansion joints and expansion-joint covers, direction of expansion, roof-penetration flashing, and connections to adjoining work.
5. Shop drawings shall include project-specific interface conditions and depict integration with adjacent roof, wall panels and exterior wall conditions.

C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Product test reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

1.6 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install roof edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 20 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying stripable, temporary protective film before shipping.

- B. Recycled Content of Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent. For recycled content, indicate postconsumer and preconsumer recycled content and cost.
- C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat finish.
 - 1. Exposed Coil-Coated Finish:
 - a. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.3 SHEET METAL FABRICATIONS

- A. Roof-Edge Coping & Fascia: Manufactured, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet (3.6 m) and a continuous formed- or extruded-aluminum anchor bar with integral cleat to engage fascia cover. Provide matching corner units.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide PAC-CLAD Peterson, PAC-TITE Coping with tapered profile, or comparable products.
 - 2. Material: Formed Aluminum: 0.050" thick.
 - a. One-piece exposed fascia.
 - b. Colors: As selected by Architect from manufacturer's metallic color selections:
 - 1) Color 1: "Silversmith"
 - 2) Color 2: "Weathered Zinc"
- B. Basis-of-Design Product: Subject to compliance with requirements, provide OMG, MBED style profile as indicated on the drawings, or comparable products.
 - 1. Coping and Fascia Material: Formed Aluminum: 0.050" thick.
 - a. Finish: Prefinished Kynar.
 - b. Fascia Height: As dimensioned on the drawings.
 - 2. Roof Edge Flashing shall meet ANSI/SPRI/FM 4435/ES-1 tested.
- C. Box Gutter: Manufactured, .08 prefinished aluminum gutter box style 5"x5" in section lengths not exceeding 12 feet (3.6 m) and providing 1" wide .08 aluminum straps 2-ft o.c. with 1" wide, 1/4" thick aluminum hanger 2-ft o.c. Provide matching end cap and downspout.
 - 1. Basis-of-Design Product: Hickman or equal
 - a. Finish: Prefinished Kynar Premium colors, architect to select from full range
- D. Half Round Gutter: Manufactured, .08 prefinished aluminum half round gutter sized to match existing in section lengths not exceeding 12 feet (3.6 m) and providing 1" wide .08 aluminum straps 2-ft o.c. with 1" wide, 1/4" thick aluminum hanger 2-ft o.c. Provide matching end cap and downspout
 - 1. Basis of Design Product: Hickman or equal

- a. Finish: Prefinished Kynar Premium colors, architect to select from full range

2.4 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 30 mils (0.76 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
 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. Englert Inc; Metalman HT.
 - b. Carlisle Residential, a division of Carlisle Construction Materials; WIP 300HT.
 - c. Grace Construction Products, a unit of W. R. Grace & Co.-Conn.; Grace Ice and Water Shield HT.
 - d. Henry Company; Blueskin PE200 HT.
 - e. Kirsch Building Products, LLC; Sharkskin Ultra SA.
 - f. Polyguard Products, Inc.; Deck Guard HT.
 - g. Protecto Wrap Company; Protecto Jiffy Seal Ice & Water Guard HT.
 - h. SDP Advanced Polymer Products Inc; Palisade SA-HT.
 2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
 3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.

2.5 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 1. General:
 - a. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of roofing.
 - b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed; with hex-washer head.
 - c. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish hidden gutter strap brackets fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
- B. Basis-of-Design Product Box Gutter: Subject to compliance with requirements, provide Hickman, Box Profile, or comparable products.
 - 1. Gutter Material: Formed Aluminum
 - 2. Expansion Joints: Lap type.
 - a. Finish: Prefinished Kynar 500, two-coat.
 - b. Shape: Style 'F' – box. See drawings for profile.
 - c. Size: 6" x 5"
 - d. Aluminum: 0.050 inch thick.
 - e. Color: As selected by Architect from manufacturer's full range.
 - 3. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from the same material as downspouts and anchors.
 - a. Finish: Prefinished Kynar 500, two-coat.
 - b. Hanger Style: Strap.
 - c. Size: 6" x 4"
 - d. Aluminum: 0.040 inch thick.
 - e. Color: As selected by Architect from manufacturer's full range.
 - 4. Box Gutter and rectangular downspout to be used at locations where the existing building has similar profiles
- C. Basis-of-Design Product Half Round Gutter: Subject to compliance with requirements, provide Hickman, Half Round Profile, or comparable products
 - 1. Gutter Material: Formed Aluminum
 - 2. Expansion Joints: Lap type
 - d. Finish: Prefinished Kynar 500, two-coat
 - e. Shape: Half Round profile to match existing
 - f. Size: To match existing
 - g. Aluminum: 0.050 inch thick
 - h. Color: As selected by Architect from manufacturer's full range
 - 3. Downspouts: Fabricate round downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from the same material as downspouts and anchors.

- d. Finish: Prefinished Kynar 500, two-coat
- e. Hanger Style: Strap
- f. Size: 3" diameter
- g. Aluminum: 0.040 inch thick
- h. Color: As selected by Architect from manufacturer's full range
- 4. Half Round Gutter and Round downspout to be used at locations where the existing building has similar profiles.

2.7 MANUFACTURED SHEET METAL FASCIA CLADDING AND TRIM

- A. Aluminum cladding, 18-gauge, shop fabricated/extruded, with hemmed edges and concealed cleats/fasteners. Cladding shall have a 3-coat fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat, along with a removable temporary protective coverings and strippable films.

2.8 FABRICATION, GENERAL

- B. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Obtain field measurements for accurate fit before shop fabrication.
 - 2. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 3. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
 - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
 - 5. Torch cutting of sheet metal flashing and trim is not permitted.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.2 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

- B. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
 - 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 - 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- C. Install work with laps, joints, and seams that are permanently watertight and weatherproof.
- D. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with cleat anchored to substrate.
 - 1. Reglets to occur where adhered elastomeric roof membrane meets masonry walls and extends up to meet the reglet. Reglet should be located a minimum of 8" above the roof surface.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 - 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 - 2. Extend counterflashing 4 inches (100 mm) over base flashing.
 - 3. Lap counterflashing joints minimum of 4 inches (100 mm).
 - 4. Secure in a waterproof manner by means of interlocking folded seam unless otherwise indicated.

3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION 07 62 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes joint sealants, fillers and adhesives for the following applications, including those specified by reference to this Section:

- 1. Interior joints in the following vertical surfaces and horizontal surfaces:

- a. Control and expansion joints on exposed surfaces of masonry walls.
 - b. Joints where countertops abut vertical surfaces.
 - c. Perimeter joints between interior wall surfaces and frames of interior doors windows, elevator entrances and wood bases.
 - d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - e. Tile control and expansion joints.
 - f. Stone threshold setting.

- B. Related Sections include the following:

- 1. Division 8 Section "Glazing".
 - 2. Division 7 Section "Asphalt Shingles" for roof assembly.
 - 3. Division 9 Section "Gypsum Board Assemblies" for locations of perimeter joints of gypsum board partitions to reduce sound transmission, with products specified in this section.
 - 4. Division 8 Sections "Wood Doors" and "Hollow Metal Doors and Frames" for sealants applied to junction of door frames and partitions.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples 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 type 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. Field Test Report Log: For each elastomeric sealant application.
- E. Warranties: Special warranties specified in this Section.

1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When joint substrates are wet.
 - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two (2) years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric 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: Five (5) years from date of Substantial Completion.
- C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
 - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
 - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance are caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products listed.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- C. Architectural Sealants:
1. Toxicity/IEQ:
 - a. Comply with applicable regulations regarding toxic and hazardous materials, and as specified. Sealants must meet or exceed requirements South Coast Air Quality Management District (SCAQMD) #1168.
 - b. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquidapplied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, and for all countertop sealants provide products that comply with 21 CFR 177.2600.
- D. Single-Component Neutral-Curing Silicone Sealant [ES-1]:
1. Available Products:
 - a. GE Silicones; SilPruf SCS2000.
 - b. Pecora Corporation; 864.
 - c. Pecora Corporation; 890.

- d. Polymeric Systems Inc.; PSI-641.
 - e. Sonneborn, Division of ChemRex Inc.; Omniseal.
 - f. Tremco; Spectrem 3.
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 50.
 - 4. Use Related to Exposure: NT (nontraffic).
- E. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant [ES-2]:
- 1. Products:
 - a. Dow Corning; 786 Mildew Resistant.
 - b. Pecora Corporation; 898.
 - c. Tremco; Tremsil 600.
 - 2. Type and Grade: S (single component) and NS (nonsag).
 - 3. Class: 25.
 - 4. Use Related to Exposure: NT (nontraffic).
 - 5. Uses Related to Joint Substrates: M, G, A, and O.

2.4 LATEX JOINT SEALANTS

- A. Latex Sealant [LS]: Comply with ASTM C 834, Type P, Grade NF.
- B. Available Products:
- 1. Bostik Findley; Chem-Calk 600.
 - 2. Pecora Corporation; AC-20+.
 - 3. Schnee-Morehead, Inc.; SM 8200.
 - 4. Sonneborn, Division of ChemRex Inc.; Sonolac.
 - 5. Tremco; Tremflex 834.

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant [AS] for Exposed and Concealed Joints [AS] Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
- 1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 2. Elastomeric Flexible Clear Sealants:
 - a. Sound Specialties Coatings Corporation: Slickthane high solids polyurethane-acrylic blend, single component ambient or heat cure, zero to low VOC, waterborne. B. Non-hardening fire-stop sealant:

1. Gun or trowel-applied intumescent sealant: 3M “CPW-25WB+” or approved equal.
2. Moldable intumescent putty: 3M “Fire Barrier Moldable Putty+” or approved equal.
3. Non-intumescent silicone sealant: 3M “Silicone Fire Stop”, USG “SmokeSeal” or approved equal) may be used in lieu of the sealant on foam rod in noise sensitive walls that are also fire rated.

2.6 FOAM BACKER ROD

- A. Closed cell polyethylene backer rod, ASTM C1193
- B. Acceptable Manufacturers: ITP, Nomaco, or approved equal (available through Tom Brown, Inc. 800446-2298)

2.7 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; 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, Type or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.8 EXPANSION JOINT FILLER

- A. W.R. Meadows, Sealtight, multi-purpose expansion-contraction joint filler in recommended thickness for anticipated range of joint movement. Adhere to one plane surface.

2.9 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: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

2.10 ADHESIVES

- A. Material recommended by adhesive manufacturer for application of material to substrate for intended application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Other porous substrates.
 - 3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Porcelain enamel.
 - b. Glazed surfaces of ceramic tile.
 - c. Other porous substrates.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged.

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. Sealants for Stone Masonry: Provide non-staining sealant systems as certified by test data and as recommended by manufacturer for sealing interior and exterior stone facing joints.
 - D. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
1. Furnish and install acoustical sealant at the following locations:
 - a. All penetrations of partition, wall, and floor construction by ductwork, conduit, piping, or structure
 - b. All termination of partitions enclosing Noise Critical Spaces to abutting construction (e.g. partitions, structure, etc.)
 - c. Both sides of door frames to abutting construction where doors are scheduled to have acoustical seals
 - d. Both sides of window frames to adjacent construction at windows in partitions enclosing Noise Critical Spaces.
 - e. Perimeter of penetrations through sound isolating ceilings, roof systems, and floor systems
 2. Backer Rod shall be used in all joints greater than ¼ inch. Product to be constructed of closed cell foam, or appropriate resilient material for sealant. Dimension shall be minimum 30% greater than joint width, unless otherwise indicated on details.

- E. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- F. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- G. 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.
- H. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 - 4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

- 1. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
- 2. Inspect tested joints and report on the following:
 - a. Whether sealants 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 type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
 - b. Whether sealants filled joint cavities and are free of voids.
 - c. Whether sealant dimensions and configurations comply with specified requirements.

3. 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.
4. 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 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 Sealant Schedule:

<u>LOCATION</u>	<u>SYSTEM NO.</u>	<u>CUSTOM COLOR</u>
Masonry/Masonry	ES-1	Yes
Masonry/Metal	ES-1	Yes
Metal/Metal	ES-1	Yes
Tile/Fixtures	ES-2	Yes
Painter's Caulk	LS	No
Interior Acoustical Joints	AS	No

END OF SECTION 07 92 00

SECTION 08 11 13 - 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 other Division 01 Specification Sections, apply to this Section.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.2 SUMMARY

- A. Section includes:
 - 1. Interior standard steel doors and frames.
 - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Division 08 Section "Flush Wood Doors" for interior solid-core wood doors installed in aluminum frames.
 - 2. Division 08 Section "Aluminum-Framed Entrances" for aluminum door frames.
 - 3. Division 08 Section "Glazing" for glass view panels in doors.
 - 4. Division 08 Section "Door Hardware" for hardware requirements.
 - 5. Division 09 Section "Painting" for field painting primed doors and frames.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 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 each different wall opening condition.
 - 6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 - 7. Details of anchorages, joints, field splices, and connections.
 - 8. Details of accessories.
 - 9. Details of moldings, removable stops, and glazing.
- C. Door Schedule: Indicate door and frame location, type, size, fire protection rating, and swing. Use the same reference designations indicated on the Drawings in preparing schedule for doors and frames.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS.

- A. Special warranties.
- B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: (5) years from date of Substantial Completion.
- B. Installer's Warranty: Installer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: (2) years from date of Substantial Completion.

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. Steelcraft.

2.2 PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
 1. Product Certification: AMMA certified with label attached to each door.
- B. Thermal Transmittance: NFRC 100 maximum total fenestration product U-factor of 0.30 Btu/sq. ft. x h x deg F.

2.3 DOOR AND FRAMES, GENERAL

- A. Hollow Metal Doors: 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 and ANSI/NAAMM HMMA 867.
- B. Hollow Metal Frames: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

2.4 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. 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. Basis-of-Design Products:
 - a. Curries Company (CU) - Polystyrene Core - 707 Series.
 - b. Curries Company (CU) - Steel-Stiffened - 747 Series.

2. Design: Flush panel.
 3. 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.
 4. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 5. 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.
 6. 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.
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
1. Basis of Design Product: Curries Company (CU) - M Series.
 2. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 3. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.

2.5 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- 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 vertical steel-stiffener core. Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
 - a. Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM pC 1363.
 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. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Basis-of-Design Product: Curries Company (CU) - Thermal Break TQ Series.
 2. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
 3. Fabricate fully welded frames with mitered or coped corners. Profile as indicated on drawings.
 4. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.

2.6 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.
- 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.

2.7 MATERIALS

- A. Recycled Content: Provide steel with minimum 25 percent post-consumer recycled content.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.
- F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

- G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.8 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. Louvers: Factory cut openings in door and install louvers into prepared openings where indicated.
 - 4. 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.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
 - 6. 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. 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.
 - 4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
 - 5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

6. 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.
 7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
 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.

2.9 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. 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 square, level, twist, and plumb condition.
- 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, leveled, 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.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections.
1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

3.5 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 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

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.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core flush wood veneer-faced doors for transparent finish.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Division 08 Section "Aluminum-Framed Entrances" for aluminum door frames.
 - 2. Division 08 Section "Door Hardware" for hardware requirements.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site. Discuss coordination with hardware and access control installers.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:
 - 1. Door core materials and construction.
 - 2. Door edge construction
 - 3. Door face type and characteristics.
 - 4. Door trim for openings.
 - 5. Door frame construction.
 - 6. Factory-machining criteria.
 - 7. Factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
 2. Details of frame for each frame type, including dimensions and profile.
 3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
 4. Dimensions and locations of blocking for hardware attachment.
 5. Dimensions and locations of mortises and holes for hardware.
 6. Clearances and undercuts.
 7. Requirements for veneer matching.
 8. Doors to be factory finished and application requirements.
- C. Door Schedule: Indicate door and frame location, type, size, fire protection rating, and swing. Use the same reference designations indicated on the Drawings in preparing schedule for doors and frames.
- D. Samples for Initial Selection: For factory-finished doors.
1. Color charts consisting of actual materials in small sections showing the full range of colors available for stained finishes.
- E. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
 2. Light Opening Moldings: Minimum 6 inches long, for each material, type, and finish required.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Sample Warranty: For special warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Special warranties.
- B. Record Documents: For all doors, list of door numbers and applicable room name and number to which door accesses.
- 1.7 QUALITY ASSURANCE
- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with WDMA Architectural Woodwork Quality Standards Illustrated.
1. Provide WDMA Quality Certification Labels or a WDMA letter of licensing for Project indicating that doors comply with requirements of grades specified.
 2. When requested, provide evidence that the installer has successful experience completing projects of similar scope and with products as specified herein.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors 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.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty shall be in effect during specified period of time from date of Substantial Completion.
 - 4. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush factor-finished stained wood doors single manufacturer.
- B. Basis-of-Design Product: subject to compliance with requirements, provide 'Aspiro Series' flush wood doors by Masonite Architectural or a comparable product by one of the following manufacturers, but not limited to:
 - 1. VT Industries
 - 2. RK Doors

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A "Industry Standard for Interior Architectural Wood Flush Doors".

2.3 SOLID-CORE THREE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
2. ANSI/WDMA I.S. 1A Quality Grade: Premium.
3. Faces: Single-ply wood veneer not less than 1/50 inch thick.
 - a. Species: White Birch.
 - b. Cut: Plain sliced (flat sliced).
 - c. Match between Veneer Leaves: Book match.
 - d. Assembly of Veneer Leaves on Door Faces: Running match.
 - e. Pair and Set Match: Provide for doors hung in same opening.
 - f. Finish: Clear
 - g. Installation: Typical Flush wood door per door schedule.
4. Exposed Vertical Edges: Same species as faces - Architectural Woodwork Standards edge Type A.
 - a. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.
5. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-2 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed for installation of hardware and to eliminate through-bolting hardware.
6. Construction: Three plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces.
2. Profile: Flush rectangular beads.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Premium.
2. Finish: ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
3. Staining: As selected by Architect from manufacturer's full range.
4. Effect: Open-grain finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
 - 1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 - 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 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.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.1 SUMMARY

- A. Section Includes:
 - 1. Interior and exterior storefront framing.
 - 2. Interior and exterior manual-swing entrance doors.

1.2 REFERENCE SPECIFICATIONS

- A. Division 08 Section "Glazing"

1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

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.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 3. Include point-to-point wiring diagrams.
- C. Samples for Initial Selection: For units with factory-applied color finishes.

- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- C. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors.
- B. Product Options: Information on Drawings and Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.

2. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Finish Warranty: Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Provide glazed aluminum curtain-wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:
1. Structural loads.
 2. Thermal movements
 3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 4. Dimensional tolerances of building frame and other adjacent construction.
 5. Failure includes the following:
 - a. Deflection exceeding specified limits.
 - b. Thermal stresses transferred to building structure.
 - c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Sealant failure.
- B. Structural Loads:
1. As indicated on the structural drawings.
- C. Structural-Test Performance: Systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Duration: As required by design wind velocity but not less than 60 seconds.
- D. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.

2. Cantilever Deflection: Where framing members overhang an anchor point, limited to 2 times the length of cantilevered member, divided by 175.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
1. Fixed Framing and Glass Area:
 - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 2. Entrance Doors:
 - a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
 - b. Single Doors: Maximum air leakage of 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
- F. Energy Performance for exterior assemblies: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall be thermally broken and have maximum u-factor of 0.32 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 2. Thermal Transmittance (U-factor): Entrance doors shall be thermally broken and have a maximum u-factor of 0.7 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
 3. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient (SHGC) of maximum 0.35 as determined according to NFRC 200.
 4. Condensation Resistance Factor for Fixed glazing and framing areas: The glass to exterior CRF, when tested to AAMA Specification 1503, shall be 70 (frame) and 69 (glass) minimum.
 5. Condensation Resistance Factor for exterior Entrance doors: when tested to AAMA Specification 1503, the CRF shall be 49 (frame) and 68 (glass) minimum.
- G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: 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.

2.2 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include the following:
1. Kawneer Company, Inc.
 2. EFCO Corporation.
 3. YKK AP America Inc.
 4. Oldcastle Building Envelope.
- B. Basis-of-Design Products: Kawneer Company, Inc.

1. Exterior Framing: Trifab VG 451T Storefront System, Size: 2" x 4 1/2"
 2. Exterior Doors: 500T wide stile Insulpour Thermal door with 10" bottom rail
- C. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken exterior
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Glazing Plane: Front
 4. Finish: Anodic Finish – Clear Anodized.
 5. Fabrication Method: Shop-assembled, Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - a. Sheet and Plate: ASTM B 209.
 - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
 - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
 - d. Structural Profiles: ASTM B 308/B 308M.

2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: Wide stile; 5-inch nominal width.
 3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Division 8 "Door Hardware."

- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
 - 1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
 - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
 - 3. Opening-Force Requirements:
 - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbf to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
 - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.
- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Continuous-Gear Hinges: Manufacturer's standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame.
- E. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
- F. Manual Flush Bolts: BHMA A156.16, Grade 1.
- G. Panic Exit Devices: BHMA A156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- H. Cylinders: As specified in Division 8 "Door Hardware".
- I. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- J. Operating Trim: BHMA A156.6.
- K. Removable Mullions: BHMA A156.3, extruded aluminum.
 - 1. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.
- L. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

- M. Concealed Overhead Holders: BHMA A156.8, Grade 1.
- N. Surface-Mounted Holders: BHMA A156.16, Grade 1.
- O. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- P. Weather Stripping: Manufacturer's standard replaceable components.
 - 1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
 - 2. Sliding Type: AAMA 701/702, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.
- Q. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- R. Silencers: BHMA A156.16, Grade 1.
- S. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch

2.6 GLAZING

- A. Glazing: Comply with Division 8 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.
 - 1. Verify sealant has a VOC content of 250 g/L or less.
 - 2. For sealants, indicating compliance with requirements for low-emitting materials.

2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.
- E. Sill Plate: Manufacturer's standard corrosion-resistant sill plate for drainage of system.

2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing.
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At exterior doors, provide compression weather stripping at fixed stops.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 ALUMINUM DOOR FINISHES

- A. Fluoropolymer Three Coat Coating System: Manufacturer's standard three coat, thermocured system composed of specially formulated inhibitive primer, fluorocarbon color coat, and a clear fluorocarbon topcoat (applicable with three coat system). Both color coat and clear topcoat shall contain not less than 70% polyvinylidene resin by weight in compliance with AAMA 2605 for testing, performance, and application procedures.

1. Panels shall be chemically etched by an appropriate cleaner in accordance with manufacturer's written instructions.
2. Apply acid resistant primer to cleaned aluminum. Thickness range; 0.20 to 0.30 mils.
3. Apply polyvinylidene fluoride (PVF2) resinated color coat. Thickness range; 0.8 to 1.2 mils.
 - a. Kynar 500. Must be applied by certified Kynar coater.
4. Apply clear top coat finish as extra protection, no less than 0.8 mils thick. Comply with AAMA standards.
5. Color: Custom color to match architect's sample, or if none, from manufacturer's standard selection

2.10 ALUMINUM FRAME FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
- B. Anodized Finishing: Prepare aluminum surfaces for specified finish; apply shop finish in accordance with the following:
 1. Anodic Coating: Electrolytic color coating followed by an organic seal applied in accordance with the requirements of AAMA 612. Aluminum extrusions shall be produced from quality controlled billets meeting AA-6063-T5.
 2. Exposed Surfaces shall be free of scratches and other serious blemishes.
 3. Extrusions shall be given a caustic etch followed by an anodic oxide treatment and then sealed with an organic coating applied with an electrodeposition process.
 4. The anodized coating shall comply with all of the requirements of AAMA 612: Voluntary Specifications, Performance Requirements and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum. Testing shall demonstrate the ability of the finish to resist damage from mortar, salt spray, and chemicals commonly found on construction sites, and to resist the loss of color and gloss
 5. Overall coating thickness for finishes shall be a minimum of 0.7 mils
- C. Finishes Testing:
 1. Apply 0.5% solution NaOH, sodium hydroxide, to small area of finished sample area; leave in place for sixty minutes; lightly wipe off NaOH; Do not clean area further.
 2. Submit samples with test area noted on each sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

F. Install glazing as specified in Division 8 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.3 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet
3. Alignment: limit offset from true alignment to 1/16 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. 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 entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 41 13

SECTION 08 45 13 - STRUCTURED-POLYCARBONATE-PANEL ASSEMBLIES

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.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.2 SUMMARY

- A. Section includes aluminum-framed assemblies glazed with translucent polycarbonate panels as follows:
 - 1. Translucent unit panel roof / skylight system

1.3 PREINSTALLATION MEETING

- A. Discussion topics should include the following: schedule; sequence; coordination of trades; substrate review and acceptance; protection; shop drawings and submittals; interface conditions and details; environmental constraints; testing requirements; field quality control efforts. Meetings shall be attended by owner, construction manager, sub-contractor, architect, engineers, etc. at the job site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
- B. Shop Drawings: For panel assemblies.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
 - 3. Shop drawings shall include project-specific interface conditions and depict integration with adjacent exterior wall conditions.
- C. Samples: In manufacturer's standard size.
 - 1. For each type of structured-polycarbonate panel.
 - 2. For each type of exposed finish for framing members.

- D. Fabrication Samples: Of each framing system intersection and adjacent panels, made from 12-inch (305-mm) lengths of full-size framing members and showing details of the following:
 - 1. Joinery.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Translucent polycarbonate panels.
 - 5. Flashing and drainage.
- E. Submittal: For panel assemblies indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each translucent polycarbonate-panel assembly, for tests performed by a qualified testing agency.
- C. Evaluation Reports: For translucent polycarbonate-panel assemblies from ICC-ES.
- D. Field quality-control reports.
- E. Sample Warranties: For special warranties.
- F. Manufacturer's installation instructions.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For panel assemblies to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or fabrication workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - c. Water leakage.

2. Warranty Period: Five years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace translucent polycarbonate panels that exhibit defects in materials or workmanship within specified warranty period.
1. Defects include, but are not limited to, the following:
 - a. Delamination.
 - b. Color changes exceeding requirements.
 - c. Losses in light transmission beyond 6 percent from original when measured after 10 years according to ASTM D 1003.
 2. Warranty Period: 10 years from date of Substantial Completion.
 3. Warranty Period for Hail Damage: Five years from date of Substantial Completion for hail stone penetration exceeding requirements.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
 2. Warranty Period: 10 years from date of Substantial Completion.
- D. Installer's Warranty: Installer agrees to repair or replace components of panel assemblies that fail in installation workmanship within specified warranty period.
1. Failures include, but are not limited to, installation defects and water leakage.
 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design translucent polycarbonate-panel assemblies."
- B. Structural Loads: As indicated on Drawings.
- C. Deflection Limits:
1. Vertical Panel Assemblies: Limited to 1/120 of clear span for each assembly component of aluminum framing and panel joint according to the IBC, Table 1604.3 for exterior walls with flexible materials.
 2. Overhead Panel Assemblies: Limited to 1/60 of clear span for each assembly component of aluminum framing and panel joint according to the IBC, Table 1604.3, footnote h.
- D. Structural-Test Performance: Panel assemblies tested according to ASTM E 330, as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified deflection limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- E. Windborne-Debris-Impact-Resistance Performance: Panel assemblies that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and the testing information in ASTM E 1996 for Wind Zone 2.
1. Large-Missile Test: For glazed openings located within 30 feet (9.1 m) of grade.
 2. Small-Missile Test: For glazed openings located more than 30 feet (9.1 m) above grade.
- F. Hail-Stone Impact Resistance: Panel assemblies that resist penetration by hail stone smaller than 1-3/16 inches (30 mm) in diameter, impacting panel surface at a final velocity up to 44 fps (13.4 m/s) per ASTM E 822.
- G. Panel Clip Performance: Corrosion-resistant clips tested to meet a minimum 90-lb/sq. ft. (4.3-kPa) wind uplift when tested according to ASTM E 330.
- H. Panel End Seals: Continuous factory-applied, self-adhered micro-filter tape over open panel cells and factory heat-seal-cripped open panel cells.
- I. Panel Performance:
1. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
 2. Flame Spread: 25 or less when tested according to ASTM E 84.
 3. Combustibility Classification: Class CC1 based on testing according to ASTM D 635.
 4. Interior Finish Classification: Class A based on testing according to ASTM E 84.
 5. Visible Light Transmittance (VT) Loss: 6 percent maximum over 10 years, measured according to ASTM D 1003.
 6. Thermal Aging: When exposed to 300 deg F (149 deg C) for 25 minutes, interior and exterior panels tested according to ASTM D 2244.
 - a. Color Retention: 0.75 (Hunter) units ΔE maximum fade.
 - b. Color Darkening: 0.3 (Hunter) units ΔL maximum.
 - c. Cracking or Crazing: None when exposed to 300 deg F (149 deg C) for 25 minutes.
 - d. Delamination: None when exposed to 300 deg F and 0 deg F (plus 149 and minus 17.8 deg C) for 25 minutes.
 7. Impact Resistance: No failure at an impact of 500 lbf (677.9 Nm) when tested according to ASTM E 695.
 8. Concentrated Loading: No damage while applying a load of 600 lbf (813.5 Nm) over 1 sq. ft. (0.093 sq. m.) when tested according to 29 CFR 1910.23(e)(8); and no damage while applying a load of 400 lbf (542.3 Nm) over 3 inches (152 mm) in diameter according to ASTM E 661.
 9. Basis of Design NFRC Requirements:
 - a. CPD#: KLA-M-5-00001-00005

- b. U-factor: 0.29
 - c. SHGC: 0.23
 - d. VT: 0.10
 - e. Condensation Resistance: 40
 - f. Anodized: M006.5 10mm UQ(white Matte)|10mm UQ(White Matte)
- J. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
- K. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- L. Energy Performance: Provide panel assemblies with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below and certified and labeled according to NFRC.
- 1. Thermal Transmittance (U-Factor): Fixed panel and mill finish aluminum framing whole assemblies shall have U-factor of not more than 0.29 Btu/sq. ft. x h x deg F (1.59 W/sq. m x K) vertical application and 0.31 Btu/sq. ft. x h x deg F (1.76 W/sq. m x K) sloped application as determined according to NFRC 100.
 - 2. Solar-Heat-Gain Coefficient (SHGC): Panel assembly shall have an SHGC of no greater than 0.23 as determined according to NFRC 200.
 - 3. Visible Light Transmittance (VT): White Matte, 0.10 or greater according to NFRC 202; White matte 0.10, according to ASTM E 972, ASTM E 1084.
 - 4. Air Infiltration: Maximum air leakage through fixed glazing and skylight framing assemblies of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - 5. Air Infiltration: Maximum air leakage through fixed window glazing and framing assemblies of 0.20 cfm/sq. ft. (1.02 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
 - 6. Air Infiltration: Maximum air leakage through fixed curtain wall and storefront glazing and framing assemblies of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

2.2 TRANSLUCENT POLYCARBONATE-PANEL ASSEMBLIES

- A. Translucent Polycarbonate-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with translucent polycarbonate panels.
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Kingspan; QuadSpan (formerly Quadwall) or an approved equal product by one of the following:

- a. Sunlite System by Palram Americas

2.3 TRANSLUCENT POLYCARBONATE WALL PANELS

- A. Translucent, Multiwall Cellular Polycarbonate Panel Thermally Broken Assembly: Consisting of two independent, multiwall cellular cross-section, polycarbonate glazing panels with air-insulated spaces and coextruded UV protection, integrated into a panel assembly with concealed metal connectors consisting of a two-piece male/female battens with built-in silicone gaskets. Unitized panel assembly shall be incorporated into a complete aluminum frame system without exposed mullions. Design panels for exterior panel replacement, independent of interior single panel and without exposing the interior, or compromising weather-tightness, or interfering with the normal working functions of the building.
- B. Panel Thickness: Overall assembly minimum 4 inch (102 mm).
- C. Perimeter Frame Thermal Break: 0.25-inch- (6.4-mm-) minimum, poured and debridged separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum framing.
- D. UV Resistance: Coextruded on weather-exposed surfaces during glazing panel manufacture.
- E. Color: As selected by Architect from manufacturer's full range.
- F. 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.
 - 1. Sound Transmission Class (STC): Paired-panel assemblies shall have a minimum overall acoustic value of the following STC:
 - a. Paired-Panel Assembly; 4 Inches (101 mm) Thick: STC 26.
- G. Panel Performance:
 - 1. Color Retention: 3.0 (Hunter) units ΔE , maximum fade as measured according to ASTM D 2244 when tested on minimum of two white color samples after panels have weathered outdoors in Arizona with panels exposed to a minimum 36.78 Langleys (1540 MJ/sq. m).
 - 2. Haze Factor: Greater than 90 percent when tested according to ASTM D 1003.

2.4 ALUMINUM FRAMING SYSTEMS

- A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.
- B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.
 - 1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
 - 2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
 - 3. Extruded Structural Pipe and Tubes: ASTM B 429 (/B 429M).

- 4. Structural Profiles: ASTM B 308 (/B 308M).
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.
- D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.
 - 1. At closures, retaining caps, or battens, use ASTM A 193 (/A 193M), 300 series stainless-steel screws.
 - 2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123 (/A 123M) or ASTM A 153 (/A 153M) requirements.
- F. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.
- G. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- H. Exposed Flashing and Closures: Aluminum sheet not less than 0.040-inch (1.02-mm) thick, finished to match framing.
- I. Framing Gaskets: Manufacturer's standard gasket system with low-friction surface treatment designed specifically for retaining translucent polycarbonate panels.
- J. Frame-System Sealants: As recommended in writing by manufacturer.
 - 1. Sealant shall have a VOC content of 250 g/L or less.
- K. Corrosion-Resistant Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- L. White Cover Board over Semi Rigid Insulation, where solid wall.

2.5 FABRICATION

- A. Fabricate aluminum components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Internal guttering systems or other means to drain water passing through joints and moisture migrating within assembly to exterior.
- B. Fabricate aluminum sill closures with weep holes and for installation as continuous component.
- C. Reinforce aluminum components as required to receive fastener threads.

2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions.
 - 1. Do not install damaged components.
 - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
 - 3. Rigidly secure nonmovement joints.
 - 4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
 - 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
 - 1. Alignment: Limit offset from true alignment to 1/32 inch (0.8 mm) where surfaces abut in-line, edge-to-edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches (76 mm); otherwise, limit offset to 1/8 inch (3.2 mm).
 - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3.2 mm in 3.7 m), but no greater than 1/2 inch (12 mm) over total length.

3.3 FIELD QUALITY CONTROL

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

1. Water-Spray Test: Before installation of interior finishes has begun, panel assemblies shall be tested according to AAMA 501.2 and shall not show evidence of water penetration.
 2. Water Penetration under Static Pressure: Before installation of interior finishes has begun, areas shall be tested according to ASTM E 1105.
 - a. Test Procedures: Test under uniform and cyclic static-air pressure.
 - b. Static-Air-Pressure Difference: As indicated on the drawings.
 - c. Water Penetration: None.
- B. Repair or remove work where test results and inspections indicate that it does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

END OF SECTION 08 45 13

SECTION 08 54 00 – COMPOSITE WINDOWS

PART 1 – GENERAL

1.1 SECTION INCLUDES

- A. Double Hung composite windows complete with hardware, glazing, weather strip, insect screen, grilles-between-the-glass, simulated divided lite, jamb extension, and standard or specified anchors, trim, and attachments.

1.2 RELATED SECTIONS

- A. Section 01 25 00 – Substitution Procedures
- B. Section 01 33 00 – Submittal Procedures
- C. Section 07 92 00 – Joint Sealants
- D. Section 09 90 00 – Paints and Coatings

1.3 REFERENCES

- A. ASTM, International:
 - 1. E283: Standard Test Method for Determining Rate of Air Leakage through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
 - 2. E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference
 - 3. E547: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls, by Cyclic Air Pressure Difference
 - 4. E2190: Standard Specification for Insulating Glass Unit Performance and Evaluation
 - 5. C1036: Standard Specification for Flat Glass
 - 6. E2112: Standard Practice for Installation of Exterior Windows, Doors, and Skylights
- B. North American Fenestration Standard (NAFS) - American Architectural Manufacturer's Association/Window and Door Manufacturer's Association/Canadian Standards Association (AAMA/WDMA/CSA 101/I.S.2/A440):
 - 1. AAMA/WDMA/CSA 101/I.S.2/A440-17: NAFS: North American Fenestration, Standard/Specification for windows, doors, and skylights
- C. Window and Door Manufacturers Association (WDMA)
 - 1. WDMA I.S.4: Industry Standard for Water Repellent Preservative Treatment for Millwork

2. WDMA I.S.2: Hallmark Certification Program

D. Insulating Glass Certification Council (IGCC) and Fenestration Glazing Industry Alliance (FGIA)
Glass Products Council (GPC)

E. Fenestration Glazing Industry Alliance (FGIA) – note: AAMA combined with IGMA and formed
FGIA as of 08/01/2019

1. AAMA 2605: Voluntary Specification for High Performance Organic Coatings on
Architectural Extrusions and Panels

F. National Fenestration Rating Council (NFRC):

1. NFRC 101: Procedure for Determining Fenestration Product Thermal Properties

2. NFRC 200: Procedure for Determining Solar Heat Gain Coefficients at Normal Incidence

G. Window Covering

1. WCMA A100.0: American National Standard for Safety of Window Covering Products

1.4 System Description

A. Design and Performance Requirements:

1. Missile Impact at Missile Level D complies with ASTM E 1886-05 and ASTM E 1996-05
2. Impact Pressure Cycling at +55/-65 psf, complies with ASTM E 1886-05 and ASTM E 1996-05
3. Forced Entry Resistance complies with ASTM F588

1.5 Submittals

A. Shop Drawings: For composite windows. Include plans, elevations, sections, full-size details,
and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring with the assembly to the exterior.
 2. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- B. Product Data: For each type of product.
3. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Samples for Initial Selection: For units with factory-applied color finishes.
4. Submit corner section
 5. Include glazing system, quality of construction, and specified finish.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Quality Control Submittals: Certificates: Submit manufacturer's certification indicating compliance with specified performance and design requirement under provision of CSI MasterFormat Section 01 33 23.

1.6 Quality Assurance

- A. Requirements: Consult local code for IBC [International Building Code] adoption year and pertinent revisions for information on:
1. Egress, emergency escape and rescue requirements.
 2. Basement window requirements.
 3. Windows fall prevention and/or window opening control device requirements.

1.7 Delivery

- A. Comply with provisions of Division 01.
- B. Deliver in original and protect from weather.

1.8 Storage and Handling

- A. Prime and seal wood surfaces, including to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation.
- B. Store window units in an upright position in a clean and dry storage area above ground to protect from weather under provision of CSI MasterFormat Section 01660.

1.9 Warranty

- A. Clear insulating glass with stainless steel spacers is warranted against seal failure caused by manufacturing defects and resulting in visible obstruction through the glass for twenty (20) years from the original date of purchase. Glass is warranted against stress cracks caused by manufacturing defects from ten (10) years from the original date of purchase.
- B. Hardware and other non-glass components are warranted to be free from manufacturing defects for ten (10) years from the original date of purchase.

PART 2 – PRODUCTS

2.1 Manufactured Units

- A. Description: Ultrex Double Hung and related stationary or picture units as manufactured by Marvin Windows & Doors, West Fargo, North Dakota or approved equal

2.2 Frame Description

- A. Interior: Clear pine exposed surfaces
 - 1. Kiln-dried to moisture content no greater than twelve (12) percent at the time of fabrication
 - 2. Water repellant, preservative treated in accordance with ANSI/NWWDA I.S.4.
- B. Exterior: Pultruded reinforced fiberglass Ultrex®, 0.075" (2 mm) thick.
- C. Composite frame thickness: 1 13/16" (46mm)
- D. Frame width: 4 9/16" (116 mm)
- E. Frame Expander accessory is an insert kit shipped as ready-to-install.
 - 1. Insert kit includes four fabricated frame expander components, including head-jamb, sill and both jamb components.
 - 2. Included in both 1" and 3" frame expander options.

2.3 Sash/Panel Description

- A. Interior: Pine
 - 1. Kiln-dried to moisture content no greater than twelve (12) percent at time of fabrication
 - 2. Water repellant preservative treated in accordance with ANSI/NWWDA I.S.4.
- B. Exterior: Pultruded reinforced fiberglass Ultrex®, 0.075" (2 mm) thick
- C. Sash Options
 - 1. Equal or Unequal Sash
 - 2. Cottage Style (sash divided 2/5 over 3/5) or Reverse Cottage Style (3/5 over 2/5)

- D. Composite sash thickness: 1 9/16" (40 mm)
- E. Operation sash tilt to interior for cleaning or removal

2.4 Glazing

- A. Select quality complying with ASTM C1036. Insulating glass SIGMA/IGCC certified to performance level CBA when tested in accordance with ASTM E2190
- B. Glazing Method: 1 1/16" (17mm) insulated glass
- C. Glass Type: Low E2 with Argon gas between lites
- D. Glass Type Options: Clear insulated glass unit
- E. Glazing Seal: Silicone bedding on both interior and exterior surfaces
- F. Glazing option: STC/OITC upgrade

2.5 Finish

- A. Exterior:
 - 1. Pultruded Fiberglass.
 - 2. Factory baked on acrylic urethane.
 - 3. Meets AAMA 624-10 requirements.
 - 4. Color: Stone White, Pebble Gray, Bronze, Cashmere, Gunmetal, Ebony.
- B. Interior:
 - 1. Bare treated pine.
 - 2. Finish: White Factory Finish

2.6 Hardware

- A. Balance System: Coil spring block and tackle with nylon cord and glass filled nylon shoe and zinc locking clutch.
- B. Lock: High pressure zinc die-cast cam lock and keeper. Finish: Phosphate coated and electrostatically painted in white.
- C. Tilt Latches: Spring loaded latches for release of sash located at check rail. Finish: White.
- D. Factory-Installed Window Opening Control Device for operating units per ASTM F20990-17: a system consisting of acetal lever housed in an acetal shell on each stile of the top sash. Finish: White.
- E. Color: Applies to handle and locking hardware: White

2.7 Optional Hardware

- A. Limiter – 3” Travel – Factory or Field Applied.
 - 1. Custodial and Non-Custodial Options Available
 - 2. Units with limiters do not meet egress criteria.

2.8 Weather Strip

- A. At Bottom Sash: Rigid color matched vinyl with a hollow vinyl weather strip; interfaces against the Ultrex sill and jamb weather strip
 - 1. Color: Black
- B. Jamb Weather Strip: Robust skin covered foam weather strip is used to seal the double hung jamb. It is inserted into a rigid vinyl carrier
 - 1. Color: Beige, White, or Black
- C. Blind Stop: Vinyl with a flexible leaf seal to seal between the header and the upper sash
- D. Foam PVC gasket between the jamb and sill
- E. At Interlock: Rigid glass filled polypropylene with flexible hollow bulb
 - 2. Color: Beige, White, or Black
- F. Reduced visible beige at the exterior bottom rail.

2.9 Interior Jamb Cap

- A. Rigid PVC cover with a color matched weatherable capping; inserts into jamb liners and head jamb liner to hide exposed Ultrex.
 - 1. Color: Beige, White, or Black

2.10 Jamb Extension

- A. Furnish jamb extension: 6 9/16 inch (167 mm) or 6 13/16 inch (173 mm) factory installed
- B. Optional jamb extension: 4 11/16 inch (119 mm) or 4 13/16 inch (122 mm) or 5 1/16 inch (129 mm) – 8 9/16 inch (217 mm) shipped loose
 - 1. Color: Beige, White, or Black

2.11 Insect Screen

A. Factory installed full screen

1. Screen Mesh: 18 by 16 charcoal fiberglass (non-corrosive)

B. Factory installed half screen

1. Screen Mesh: 18 by 16 charcoal fiberglass (non-corrosive)
2. Rolled form aluminum frame
3. Finish: White, Pebble Gray, Bronze, Cashmere, Gunmetal, or Ebony

2.12 Simulated Divided Lites (SDL)

A. 7/8" (22mm) wide. Available with optional spacer bars

1. Exterior muntins: Ultrex finished to color match exterior
2. Interior muntins: White
3. Pattern: Match existing windows
4. Simulated Check rail option: 2 11/32" (60mm). Available with optional spacer bars.

2.13 Grilles-Between-the-Glass (GBG)

A. Manufactured from aluminum in a 23/32" (18mm) wide contoured profile placed between the two panes of glass.

1. Colors:
 - a. Interior: White
 - b. Exterior: White
2. Patterns:
 - a. Match existing windows

2.14 Accessories and Trim

A. Exterior Casing:

1. Non-integral to the unit – fastened to the exterior wall with barb and kerf.
2. 2" (51mm) Brick Mould Casing available as a full surround or with sill nosing
3. 3 1/2" (89mm) Flat Casing as a full surround or with sill nosing; available with 1" (25mm) ranch-style header overhang
4. Color: Stone White

B. Installation Accessories:

1. Factory-installed vinyl nailing fin/drip cap at head, sill and side jambs

2. Installation brackets: Brackets for 4 9/16" (166 mm) or 6 9/16" (167 mm) jambs
3. Mullion kit: Mullion kit for field assembly of units – Kit includes: Aluminum mull pin, Sealant foam tape, Exterior mullion cover, Interior mull trim, Mull screws, Mull bracket, Mull bracket screws

PART 3 – EXECUTION

3.1 Examination

- A. Verification of Condition: Before installation, verify openings are plumb, square and of proper dimensions as required in CSI MasterFormat Section 01 71 00. Report frame defects or unsuitable conditions to the General contractor before proceeding.
- B. Acceptance of Condition: Beginning on installation confirms acceptance of existing conditions.

3.2 Installation

- A. Comply with CSI MasterFormat Section 01 73 00.
- B. Assemble and install window/door unit(s) according to manufacturer's instruction and reviewed shop drawing.
- C. Install sealant and related backing materials at perimeter of unit or assembly in accordance with CSI MasterFormat Section 07 92 00 Joint Sealants. Do not use expansive foam sealant.
- D. Install accessory items as required.
- E. Use finish nails to apply wood trim and mouldings.

3.3 Field Quality Control

- A. Remove visible labels and adhesive residue according to manufacturer's instruction.
- B. Unless otherwise specified, air leakage resistance tests shall be conducted at a uniform static pressure of 75 Pa (~1.57 psf). The maximum allowable rate of air leakage shall not exceed 2.3 L/sm² (~0.45 cfm/ft²).
- C. Unless otherwise specified, water penetration resistance testing shall be conducted per AAMA 502 and ASTM E1105 at 2/3 of the fenestration products design pressure (DP) rating using "Procedure B" – cyclic static air pressure difference. Water penetration shall be defined in accordance with the test method(s) applied.

3.4 Cleaning

- A. Remove visible labels and adhesive residue according to manufacturer's instruction.

- B. Leave windows and glass in a clean condition. Final cleaning as required in CSI MasterFormat Section 01 74 00.

3.5 Protecting Installed Construction

- A. Comply with CSI MasterFormat Section 07 76 00.
- B. Protecting windows from damage by chemicals, solvents, paint or other construction operations that may cause damage.

END OF SECTION 08 54 00

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Finish Hardware for door openings other than detention doors, except as otherwise specified herein.
 - 1. Door hardware for steel (hollow metal) doors
 - 2. Door hardware for aluminum doors
 - 3. Door hardware for wood doors
 - 4. Keyed cylinders as indicated.
- B. Related Sections
 - 1. Division 6: Rough Carpentry
 - 2. Division 8: Aluminum-Framed Entrances and Storefronts
 - 3. Division 8: Hollow Metal Doors and Frames
 - 4. Division 8: Flush Wood Doors
- C. References: Comply with applicable requirements of the following standards. Where these standards conflict with other specific requirements, the most restrictive shall govern.
 - 1. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
 - 2. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2019.
 - 3. BHMA A156.1 - Standard for Butts and Hinges 2021.
 - 4. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.
 - 5. BHMA A156.3 - Exit Devices 2020.
 - 6. BHMA A156.4 - Door Controls - Closers 2019.
 - 7. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.
 - 8. BHMA A156.6 - Standard for Architectural Door Trim 2021.
 - 9. BHMA A156.7 - Template Hinge Dimensions 2016.
 - 10. BHMA A156.8 - Door Controls - Overhead Stops and Holders 2021.
 - 11. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.
 - 12. BHMA A156.15 - Release Devices - Closer Holder, Electromagnetic and Electromechanical 2021.
 - 13. BHMA A156.16 - Auxiliary Hardware 2018.
 - 14. BHMA A156.18 - Materials and Finishes 2020.
 - 15. BHMA A156.21 - Thresholds 2019.
 - 16. BHMA A156.22 - Standard for Gasketing 2021.
 - 17. BHMA A156.26 - Standard for Continuous Hinges 2021.
 - 18. BHMA A156.28 - Recommended Practices For Mechanical Keying Systems 2018.
 - 19. BHMA A156.30 - High Security Cylinders 2020.

20. BHMA A156.36 - Auxiliary Locks 2020.
21. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames 2016.
22. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.
23. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
24. DHI (KSN) - Keying Systems and Nomenclature 2019.
25. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.
26. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.
27. ICC (IBC) - International Building Code, 2021 Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
28. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
29. ISO 9001 - Quality management systems -- Requirements 2015.
30. ITS (DIR) - Directory of Listed Products Current Edition.
31. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
32. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
33. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
34. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
35. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
36. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
37. UL 437 - Standard for Key Locks Current Edition, Including All Revisions.
38. UL 1784 - Standard for Air Leakage Tests of Door Assemblies Current Edition, Including All Revisions.

D. Intent of Hardware Groups

1. Should items of hardware not specified be required for completion of the Work, furnish such items of type and quality comparable to adjacent hardware and appropriate for service required.
2. Where items of hardware aren't specified, are required for completion of the Work, a written statement of such discrepancy to be submitted to Architect, prior to date specified for receipt of bids for clarification by addendum; or furnish such items in the type and quality established by this specification, and appropriate to the service intended

1.2 SUBSTITUTIONS

- A. No substitutions are permitted.

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.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- 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 Procedures.

1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through current members of the manufacturer's "Power Operator Preferred Installer" program. Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- H. 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.
- I. 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), Contractor(s), Owner, and Architect to confirm hardware sets and components, review proper methods and 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 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. Review sequence of operation narratives for each unique access controlled opening.
 - 3. Review and finalize construction schedule and verify availability of materials.
 - 4. Review the required inspecting, testing, commissioning, and demonstration procedures.

- J. 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.
- 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 hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard 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.
- C. Standard Warranty Period: Two years from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
 - 1. Ten years for mortise locks and latches.
 - 2. Five years for exit hardware.

1.8 MAINTENANCE

- 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. The following manufacturers are approved subject to compliance with requirements of the Contract Documents. Approval of manufacturers other than those listed shall be in accordance with Division 1.

<u>Item:</u>	<u>Manufacturer:</u>
Hinges	Stanley
Continuous Hinges	Stanley
Locksets	Marks USA
Cylinders	Medeco
Exit Devices	Marks
Closers	Corbin Russwin DC6210-N54
Push/ Pull Plates	Don-Jo
Push/ Pull Bars	Don-Jo
Protection Plates	Don-Jo
Overhead Stops	Don-Jo
Door Stops	Don-Jo
Flush Bolts	Don-Jo
Coordinator & Brackets	Don-Jo
Threshold & Gasket	National Guard

2.2 MATERIALS

1. Hinges:
 1. Template screw hole locations
 2. Minimum of 2 permanently lubricated non-detachable bearings
 3. Equip with easily seated, non-rising pins
 4. Sufficient size to allow 180-degree swing of door
 5. Furnish hinges with five knuckles and flush [concealed] bearings
 6. Provide hinge type as listed in schedule.
 7. Furnish 3 hinges per leaf to 7 foot 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
 8. Tested and approved by BHMA for all applicable ANSI Standards for type, size, function and finish
 9. UL10C listed for Fire rated doors.
2. Geared Continuous Hinges:
 1. Tested and approved by BHMA for ANSI A156.26-1996 Grade 1
 2. Anti-spinning through fastener
 3. ULIOC listed for 3 hour Fire rating
 4. Non-handed

5. Lifetime warranty
 6. Provide Fire Pins for 3-hour fire ratings
 7. Sufficient size to permit door to swing 180 degrees
3. Mortise Type Locks and Latches:
1. Tested and approved by BHMA for ANSI A156.13, Series 1000, Operational Grade 1, Extra— Heavy Duty, Security Grade 2 and be UL10C.
 2. Furnish UL or recognized independent laboratory certified mechanical operational testing to 4 million cycles minimum.
 3. Provide 9001—Quality Management and 14001—Environmental Management.
 4. Fit ANSI A115.1 door preparation
 5. Functions and design as indicated in the hardware groups
 6. Solid, one—piece, 3/4—inch (19mm) throw, antifriction latchbolt made of self-lubricating stainless steel
 7. Deadbolt functions shall have 1 inch (25mm) throw bolt made of hardened stainless steel
 8. Latchbolt and Deadbolt are to extend into the case a minimum of 3/8 inch (9.5mm) when fully extended
 9. Auxiliary deadlatch to be made of one piece stainless steel, permanently lubricated
 10. Provide sufficient curved strike lip to protect door trim
 11. Lever handles must be of forged or cast brass, bronze or stainless-steel construction and conform to ANSI A117.1. Levers that contain a hollow cavity are not acceptable
 12. Lock shall have self—aligning, thru—bolted trim
 13. Levers to operate a roller bearing spindle hub mechanism
 14. Mortise cylinders of lock shall have a concealed internal setscrew for securing the cylinder to the lockset. The internal setscrew will be accessible only by removing the core, with the control key, from the cylinder body.
 15. Spindle to be designed to prevent forced entry from attacking of lever
 16. Provide locksets with 7-pin removable and interchangeable core cylinders
 17. Each lever to have independent spring mechanism controlling it
 18. Core face must be the same finish as the lockset.
4. Cylindrical Type Locks and Latches:
- a. Tested and approved by BHMA for ANSI A156.2, Series 4000, Operational Grade 1, Extra-Heavy Duty, and be ULIOC listed.
 - b. Provide 9001-Quality Management and 14001-Environmental Management.
 - c. Fit modified ANSI A115.2 door preparation.
 - d. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
 - e. Locksets to have anti-rotational studs that are thru-bolted
 - f. Keyed lever shall not have exposed “keeper” hole
 - g. Each lever to have independent spring mechanism controlling it
 - h. 2-3/4 inch (70 mm) backset
 - i. 9/16 inch (14 mm) throw latchbolt
 - j. Provide sufficient curved strike lip to protect door trim
 - k. Outside lever sleeve to be seamless, of one-piece construction made of a hardened steel alloy
 - l. Keyed lever to be removable only after core is removed, by authorized control key
 - m. Provide locksets with 7-pin removable and interchangeable core cylinders
 - n. Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.

- o. Locksets outside locked lever must withstand minimum 1400 inch pounds of torque. In excess of that, a replaceable part will shear. Key from outside and inside lever will still operate lockset.
 - p. Core face must be the same finish as the lockset.
 - q. Functions and design as indicated in the hardware groups.
- 5. Cylindrical Grade 2 Type Locks and Latches:
 - a. Certified by BHMA for ANSI A156.3, Series 4000, Operational Grade 2.
 - b. Fit modified ANSI A115.3 door preparation
 - c. Locksets and cores to be of the same manufacturer to maintain complete lockset warranty
 - d. 2-3/4 inch (70mm) backset, or 2 3/8 inch backset as needed
 - e. 1/2 inch (14mm) throw latchbolt
 - f. Provide locksets with 7-pin *code*.
 - g. Functions and design as indicated in the hardware groups
- 6. Exit Devices:
 - a. Exit devices to meet or exceed BHMA for ANSI 156.3, Grade 1.
 - b. Exit devices to be tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 9 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.
 - c. Exit devices chassis to be investment cast steel, zinc dichromate.
 - d. Exit devices to have stainless steel deadlocking 3/4" through latch bolt.
 - e. Exit devices to be equipped with sound dampening on touchbar.
 - f. Non-fire rated exit devices to have cylinder dogging.
 - g. Non-fire rated exit devices to have 1/4" minimum turn hex key dogging.
 - h. Touchpad to be "T" style constructed of architectural metal with matching metal end caps.
 - i. Touchbar assembly on wide style exit devices to have a 1/4" clearance to allow for vision frames.
 - j. All exposed exit device components to be of architectural metals and "true" architectural finishes.
 - k. Provide strikes as required by application.
 - l. Fire exit hardware to conform to UL10C and UBC 7-2. UL tested for Accident Hazard.
 - m. Exit device to be heavy investment cast stainless steel with black powder coated finish.
 - n. Exit devices to have field reversible handing.
 - o. Provide heavy duty vandal resistant lever trim with heavy duty investment cast stainless steel components and extra strength shock absorbing overload springs. Lever shall not require resetting. Lever design to match locksets and latchsets.
 - p. Provide 9001-Quality Management and 14001 -Environmental Management.
 - q. Vertical Latch Assemblies to have gravity operation, no springs.
- 7. Cylinders:
 - a. Provide the necessary cylinder housings, collars, rings & springs as recommended by the manufacturer for proper installation.
 - b. Provide the proper cylinder cams or tail piece as required to operate all locksets and other keyed hardware items listed in the hardware sets.
 - c. Coordinate and provide as required for related sections.
- 8. Door Closers:

- a. Tested and approved by BHMA for ANSI 156.4, Grade 1
 - b. UL10C certified
 - c. Provide 9001—Quality Management and 14001-Environmental Management.
 - d. Closer shall have extra—duty arms and knuckles
 - e. Conform to ANSI 117.1
 - f. Maximum 2 7/16 inch case projection with non-ferrous cover
 - g. Separate adjusting valves for closing and latching speed, and backcheck
 - h. Provide adapter plates, shim spacers and blade stop spacers as required by frame and door conditions
 - i. Full rack and pinion type closer with 1 1/2“ minimum bore
 - j. Mount closers on non-public side of door, unless otherwise noted in specification
 - k. Closers shall be non-handed, non-sized and multi-sized.
9. Door Stops:
- a. Wall stop and floor stop shall be wrought bronze, brass or stainless steel.
 - b. Provide fastener suitable for wall construction.
 - c. Coordinate reinforcement of walls where wall stop is specified.
 - d. Provide dome stops where wall stops are not practical. Provide spacers or carpet riser for floor conditions encountered
10. Overhead Stops: Provide a Surface mounted or concealed overhead when a floor or wall stop cannot be used or when listed in the hardware set.
- a. Concealed overhead stops shall be heavy duty bronze or stainless steel.
 - b. Surface overhead stops shall be heavy duty bronze or stainless steel.
11. Push Plates: Provide with four beveled edges ANSI J301, .050 thickness, size as indicated in hardware set. Furnish oval-head countersunk screws to match finish.
12. Pulls with Plates: Provide with four beveled edges ANSI J301, .050 thickness plates with ANSI J401 Pull as listed in hardware set. Provide proper fasteners for door construction.
13. Push/ Pull Bars: Provide ANSI J504, 1” Dia. Pull and push bar model and series as listed in hardware set. Provide proper fasteners for door construction.
14. Kickplates: Provide with four beveled edges ANSI J102, 10 inches high by width less 2 inches on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
15. Mop Plates: Provide with four beveled edges ANSI J103, 4 inches high by width less 1 inch on single doors and 1 inch on pairs of doors. Furnish oval-head countersunk screws to match finish.
16. Door Bolts: Flush bolts for wood or metal doors.
- a. Provide a set of Automatic bolts, Certified ANSI/BHMA 156.3 Type 25 for hollow metal label doors.
 - b. Provide a set of Automatic bolts, Certified ANSUBHMA 156.3 Type 27 at wood label doors.

- c. Manual flush bolts, Certified ANSI/BHMA 156.16 at openings where allowed local authority.
 - d. Provide Dust Proof Strike, Certified ANSI/BHMA 1J6.16 at doors with flush bolts without thresholds.
- 17. Coordinator and Brackets: Provide a surface mounted coordinator when automatic bolts are used in the hardware set.
 - a. Coordinator, Certified ANSI/BHMA A1156.3 Type 2IA for full width of the opening.
 - b. Provide mounting brackets for soffit applied hardware.
 - c. Provide hardware preparation (cutouts) for latches as necessary.
- 18. Seals: All seals shall be finished to match adjacent frame color. Seals shall be furnished as listed in schedule. Material shall be UL listed for labeled openings.
- 19. Weatherstripping: Provide at head and jambs only those units where resilient or flexible-seal strip is easily replaceable. Where bar-type weatherstrip is used with parallel arm mounted closers install weatherstrip first.
 - a. Weatherstrip shall be resilient seal of Silicone
 - b. ULIOC Positive Pressure rated seal set when required.
- 20. Door Bottom/ Sweeps: Surface mounted or concealed door bottom where listed in the hardware sets.
 - a. Door seal shall be resilient seal of Silicone
 - b. UL10C Positive Pressure rated seal set when required.
- 21. Thresholds: Thresholds shall be aluminum beveled type with maximum height of 1/2" for conformance with ADA requirements. Furnish as specified and per details. Provide fasteners and screws suitable for floor conditions.
- 22. Key Cabinet: Provide one wall mounted Telkee, Lund or MMF series key cabinet complete with hooks, index and tags to accommodate 50% expansion. Coordinate mounting location with architect.
- 23. Silencers: Furnish silencers on all interior frames, 3 for single doors, 2 for pairs. Omit where any type of seals occur.

2.3 FINISH

- A. Designations used in Schedule of Finish Hardware - 3.05, and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18 including coordination with traditional U.S. finishes shown by certain manufacturers for their products
- B. Powder coat door closers to match other hardware, unless otherwise noted.
- C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.4 KEYS AND KEYING

- A. Provide keyed brass construction cores and keys during the construction period. Construction control and operating keys and core shall not be part of the Owner's

permanent keying system or furnished in the same keyway (or key section) as the Owner's permanent keying system. Permanent cores and keys (prepared according to the accepted keying schedule) will be furnished to the Owner.

- B. Cylinders, removable and interchangeable core system: MEDECO.
- C. Permanent keys and cores: stamped with the applicable key mark for identification. These visual key control marks or codes will not include the actual key cuts. Permanent keys will also be stamped "Do Not Duplicate."
- D. Transmit Grand Masterkeys, Masterkeys, and other Security keys to Owner by Registered Mail, return receipt requested.
- E. Furnish Keys in the following quantities:
 - 1. 1 each Grand Masterkeys
 - 2. 4 each Masterkeys
 - 3. 2 each Change keys each keyed core
 - 4. 15 each Construction masterkeys
 - 5. 1 each Control keys
- F. The Owner, or the Owner's agent, will install permanent cores and return the construction cores to the Hardware Supplier. Construction cores and keys remain the property of the Hardware Supplier.
- G. Keying Schedule: Arrange for a keying meeting, and programming meeting with Architect Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying and programming complies with project requirements. Furnish 3 typed copies of keying and programming schedule to Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Verification of conditions: Examine doors, frames, related items and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion.
 - a. Do not proceed until unsatisfactory conditions have been corrected.

3.2 HARDWARE LOCATIONS

- A. Mount hardware units at heights indicated in the following publications except as specifically indicated or required to comply with the governing regulations.
 - 1. Recommended Locations for Builder's Hardware for Standard Steel Doors and Frames, by the Door and Hardware Institute (DHI).
 - 2. Recommended locations for Architectural Hardware for flush wood doors (DHI).
 - 3. WDMA Industry Standard I.S.-IA-04, Industry Standard for Architectural wood flush doors.

3.3 INSTALLATION

- A. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- B. Conform to local governing agency security ordinance.
- C. Install Conforming to ICC/ANSI A117.1 Accessible and Usable Building and Facilities.
 - 1. Adjust door closer sweep periods so that from the open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the landing side of the door.
- D. Installed hardware using the manufacturers fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use "Riv-Nuts" or similar products.

3.4 FIELD QUALITY CONTROL AND FINAL ADJUSTMENT

- A. Contractor/installers, Field Services: After installation is complete, contractor shall inspect the completed door openings on site to verify installation of hardware is complete and properly adjusted, in accordance with both the Contract Documents and final shop drawings.
 - 1. Check and adjust closers to ensure proper operation.
 - 2. Check latchset, lockset, and exit devices are properly installed and adjusted to ensure proper operation.
 - i. Verify levers are free from binding.
 - ii. Ensure latchbolts and dead bolts are engaged into strike and hardware is functioning.
 - 3. Report findings, in writing, to architect indicating that all hardware is installed and functioning properly. Include recommendations outlining corrective actions for improperly functioning hardware if required.

3.5 SCHEDULE OF FINISH HARDWARE

Manufacturer List:

<u>Code</u>	<u>Name</u>
BY	By Related Section
CR	Corbin Russwin
DJ	Don-Jo
MA	Marks
MD	Medeco
NA	National Guard
ST	Stanley
BO	By Owner/ Others

Finish List:

<u>Code</u>	<u>Description</u>
15	Satin Nickel Plate
28	Aluminum Anodized (Clear)

HOLT PARK BUILDING IMPROVEMENTS
BALTIMORE COUNTY, MARYLAND
CONTRACT NUMBER – 25054 GX0
JOB ORDER NUMBER – 0000971385

PROJECT MANUAL
100% CONSTRUCTION DOCUMENTS

32D	Satin Stainless Steel
626	Satin Chromium Plated
628	Satin Aluminum, Clear Anodized
630	Satin Stainless Steel
689	Aluminum Painted
AL	Aluminum
CL	Clear
US32D	Stainless Steel, Dull

END OF SECTION 08 71 00

SECTION 08 80 00 - 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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Aluminum Framed Entrances and Storefronts.
- B. Related Sections:
 - 1. Division 8 section "Aluminum Storefront" for glass panels in exterior windows and doors

1.3 DEFINITIONS

- A. Glass Manufacturers: 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.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2015 International Building Code by a qualified professional engineer, using the following design criteria:
 - 1. Design Wind Pressures: As indicated on Drawings.
 - 2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
 - 1. Insulating Glass Units
- C. Glazing Accessory Samples: For gaskets and sealants in 12-inch (300-mm) lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- F. Qualification Data: For installers manufacturers of insulating-glass units with sputter-coated, low-e coatings glass testing agency.
- G. Product Certificates: For glass and glazing products, from manufacturer.
- H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, glazing sealants, and glazing gaskets.
- I. Preconstruction adhesion and compatibility test report.
- J. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- E. Source Limitations for Glass: Obtain coated float glass and insulating glass from single source from single manufacturer for each glass type.

- F. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.
- G. 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'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, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- H. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- I. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

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 glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to 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. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to 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.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. GLAZING SCHEDULE:
1. GL-1 1" Clear Insulated Low E
- B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0mm.
- C. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick
 2. For laminated-glass lites, properties are based on products of construction indicated.
 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of 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. For uncoated glass, comply with requirements for Condition A.
 - 3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 INSULATING GLASS

- 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. PPG
 - 2. Old Castle
 - 3. Pilkington
 - 4. Or equal as approved by Architect
- B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
 - 1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary.
 - 2. Spacer: Manufacturer's standard spacer material and construction
 - 3. Desiccant: Molecular sieve or silica gel, or blend of both.
- C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types"

2.4 IMPACT SAFETY-RATED GLAZING

- A. Impact Safety-rated glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, meeting ANSI Z97.1 and CPSC 16 CFR1201 (cat.1 and 2).
- B. Monolithic Impact Safety Rated Glazing: Clear, tempered glass; 1/4-inch (6-mm) nominal thickness

2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
 - 3. Silicone complying with ASTM C 1115.

4. Thermoplastic polyolefin rubber complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.6 GLAZING SEALANTS

- A. General:
 1. Compatibility: Provide 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. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 4. Sealants used inside the weatherproofing system 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."
 5. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; 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; 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; and complying with AAMA 800 for the following types:
 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 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 of 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.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit 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 to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.10 INSULATING-GLASS TYPES

- A. GL-1 Insulating Glass Unit Type 1: Low-e coated (PPG Solarban 70XL) Clear insulating glass.
 1. Overall Unit Thickness: 1" inch (25 mm)
 2. Thickness of Each Glass Lite: ¼", 6.0 mm
 3. Outdoor Lite: Fully tempered float glass
 4. Interspace Content: Argon
 5. Indoor Lite: Fully tempered float glass
 6. Low-e coating: Sputtered on second surface
 7. Visible Light Transmittance: 64 percent minimum
 8. Winter Nighttime U-Factor: 0.28 maximum.
 9. Summer Daytime U-Factor: 0.26 maximum.
 10. Solar Heat Gain Coefficient: 0.27

11. Shading Coefficient: 0.32
12. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, 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 systems.
 3. Minimum required face and 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.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

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. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- 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 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 (1270 mm).
 - 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 (3-mm) 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. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. 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.
- L. 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 GASKET GLAZING (DRY)

- A. Cut compression gaskets to 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. Installation with Drive-in Wedge Gaskets: 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. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

- E. Install gaskets so they protrude past face of glazing stops.

3.5 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. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing 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.

END OF SECTION 08 80 00

SECTION 08 83 00 - MIRRORS

PART 1 - GENERAL

1.01 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.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.1 SUMMARY

- A. Section includes the following types of silvered flat glass mirrors:
 - 1. Framed film-mesh backed glass mirrors qualifying as safety glazing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.
- C. Samples:
 - 1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
 - 2. Mirror Clips: Full size.
 - 3. Mirror Trim: 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

- A. Preconstruction test reports.
- B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Glazing Publications: Comply with GANA's "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

- B. Safety Glazing Products: For film-mesh backed mirrors, provide products complying with testing requirements in 16 CFR 1201 for Category II materials.
- C. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing and substrates on which mirrors are installed.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

- 1. Warranty Period: Ten (10) years from date of Substantial Completion

PART 2 - PRODUCTS

2.1 SILVERED FLAT FRAMED GLASS MIRRORS

- A. Glass Mirrors, General: ASTM C 1503

- 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. Arch Aluminum & Glass Co., Inc.
 - b. Avalon Glass and Mirror Company.
 - c. Binswanger Mirror; a division of Vitro America, Inc.
 - d. D & W Incorporated
 - e. Donisi Mirror Company.
 - f. Gardner Glass, Inc.
 - g. Gilded Mirrors, Inc.
 - h. Guardian Industries.
 - i. Head West.
 - j. Independent Mirror Industries, Inc.
 - k. Lenoir Mirror Company.
 - l. Maran-Wurzell Glass & Mirror.
 - m. National Glass Industries.
 - n. Stroupe Mirror Co., Inc.
 - o. Sunshine Mirror; Westshore Glass Corp.
 - p. Virginia Mirror Company, Inc.
 - q. Walker Glass Co., Ltd.

- B. Film-Mesh Backed Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, float glass before silver coating is applied.
 - 1. Nominal Thickness: 1/4 inch
 - 2. Size: As indicated on the drawings.

2.2 MISCELLANEOUS MATERIALS

- A. Edge Sealer: Approved by mirror manufacturer.
- B. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors.
- C. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.3 FABRICATION

- A. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.
- B. Mirror Edge Treatment: One-piece 22-gauge satin finished stainless steel channel with 3/8 inch returns and mitered corners
 - 1. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- C. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer.

2.4 MIRROR HARDWARE

- A. Mirror Bottom and Top Clips: Continuous aluminum clip.
- B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.
 - 1. Verify compatibility with and suitability of substrates, including compatibility of mirror mastic with existing finishes or primers.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.
- B. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

- C. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- D. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
 - 1. Mirror Clips: Place a felt or plastic pad between mirror and each clip to prevent spalling of mirror edges. Locate clips so they are symmetrically placed and evenly spaced.
 - 2. Mount mirrors a maximum of 40" above finish floor to reflective surface – above continuous clips.
- E. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- F. Do not permit edges of mirrors to be exposed to standing water.
- G. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- H. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

END OF SECTION 08 83 00

SECTION 08 90 00 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide louvers and vents where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.
- B. Section Includes:
 - 1. Fixed metal wall louvers.
 - 2. Blank-off panels for wall louvers.
- C. Related Documents/Sections: Carefully examine the Contract Documents for requirements which affect work of this Section. Documents and specification sections containing requirements which relate to this Section include, but are not necessarily limited to:
 - 1. Section 079200 – “Joint Sealants”: Sealants installed in perimeter joints between louver frames and adjoining construction.
 - 2. Division 23 - Mechanical: Ductwork connected to metal wall louvers.

1.2 DEFINITIONS

- A. Louver Terminology: Refer to AMCA Publication 501-85 for definitions of terms for metal louvers not otherwise defined in this section or referenced standards.

1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design, engineer, fabricate, and install exterior metal wall louvers to withstand the effects of loads and stresses from wind and normal thermal movement, without evidencing permanent deformation of louver components including blades, frames, and supports; noise or metal fatigue caused by louver blade rattle or flutter; and permanent damage to fasteners and anchors:
 - 1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf per sq. ft. acting inwards or outwards.
 - 2. Normal thermal movement is defined as that resulting from the following maximum change (range) in ambient temperature. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.
 - a. Temperature Change (Range): 100 deg F (55.5 deg C).
- B. Air Performance, Water Penetration, and Air Leakage Ratings: Provide louvers complying with performance requirements indicated as demonstrated by testing manufacturers stock units, of height and width indicated, according to Air Movement and Control Association (AMCA) Standard 500.

1.4 SUBMITTALS

- A. General:
 - 1. Identify proposed changes, differences, and discrepancies, including verbiage, terms, and definitions, between Contract Documents and submittals.

B. Product Data:

1. For each type of product indicated, submit manufacturer's specifications and other data needed to prove compliance with the specified requirements.

C. Shop Drawings:

1. Submit drawings prepared under the supervision of a professional engineer currently licensed to practice in jurisdiction in which the Project is located.
2. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages installed as a unit of work under other sections.
3. Include plans, elevations, sections, and details showing profiles, angles, spacing of louver blades; unit dimensions related to wall openings and construction; free areas for each size indicated; and profiles of frames at jambs, heads and sills.
 - a. Where installed products are indicated to comply with certain structural design loadings, include structural computations, material properties, and other information needed for structural analysis which has been prepared by, or under the supervision of, a qualified professional engineer.

D. Samples:

1. Samples for Verification Purposes:
 - a. Each type of metal finish required, prepared on 6 inch square metal samples of same thickness and alloy indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

E. Quality Control Submittals:

1. Tests:
 - a. Product test reports evidencing compliance of units with performance requirements indicated.
2. Certificates:
 - a. Product certificates signed by louver manufacturers certifying that their products which comply with Project requirements are licensed to bear AMCA Seal based on tests made in accordance with AMCA Standard 500 and complying with AMCA Certified Ratings Program.
 - b. Installer certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.
3. Qualification Data:
 - a. Submit data for firms and persons specified under "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name(s), address(es), names of Architect(s) and Owner(s), plus other specified information.
4. Manufacturer's Instructions:
 - a. Submit manufacturer's recommended installation procedures which, when reviewed by the Architect, may become the basis for accepting or rejecting actual installation procedures used on the work.

F. Contract Closeout Submittals:

1. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the Architect requisite copies of the following.
 - a. Project Record Documents.
 - b. Operation and Maintenance Data.

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: Obtain louvers and vents from a single source where alike in one or more respects with regard to type, design, and factory-applied color finish.
- B. Qualify welding processes and welding operators in accordance with D1.2 "Structural Welding Code - Aluminum" and D1.3 "Structural Welding Code - Sheet Steel."
 1. Certify that each welder employed in unit of Work of this section has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 2. Testing for recertification is Contractor's responsibility.
- C. Engineer Qualifications: Professional engineer licensed to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated which has resulted in the successful installation of louvers similar in material, design, and extent to that indicated for this Project.
- D. SMACNA Standard: Comply with SMACNA "Architectural Sheet Metal Manual" recommendations for fabrication, construction details, and installation procedures.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Check actual louver openings by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Louvers:

Representative Manufacturer:

 - a. Construction Specialties, Inc. 6696 Route 405 Highway. Muncy, Pennsylvania 800-233-8493 www.c-sgroup.com

Equal Manufacturers:

 - b. Airstream Products Div., Penn Ventilator Co., Inc.
 - c. Airolite Co.
 - d. Ruskin Mfg. Div., Phillips Industries, Inc.

2.2 MATERIALS

- A. Galvanized Steel Sheet: ASTM A 526 or A 527, G90 zinc coating, mill phosphatized.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to produce required finish.
- C. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- D. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials joined.
 - 1. Use types, gages, and lengths to suit unit installation conditions.
 - 2. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- E. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.
- F. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).
- G. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, complying with SSPC-Paint-20.
- H. Recycled Content: If necessary to meet required LEED threshold, provide products with recycled content.

2.3 FABRICATION, GENERAL

- A. General: Fabricate louvers and vents to comply with requirements indicated for design, dimensions, materials, joinery, and performance.
- B. Preassemble louvers in shop to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of size indicated with allowances made for fabrication and installation tolerances of louvers, adjoining construction, and perimeter sealant joints.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated but not further apart than recommended by manufacturer, or 72 inches o.c., whichever is less. At horizontal joints between louver units provide horizontal mullions except where continuous vertical assemblies are indicated.
- G. Provide sill extensions and loose sills made of same material as louvers, where indicated, or required for drainage to exterior and to prevent water penetrating to interior.

- H. Join frame members to one another and to fixed louver blades as follows, unless otherwise indicated, or size of louver assembly makes bolted connections between frame members necessary:
1. With fillet welds, concealed from view; or mechanical fasteners; or a combination of these methods; as standard with louver manufacturer.

2.4 FIXED FORMED SHEET METAL WALL LOUVERS

- A. 6" High Performance Drainable Fixed Mullion Louvers: Frames and louver blades fabricated from metal of kind and in form indicated below.
1. Mullion material: 0.125" thick material. Sliding interlock with internal drains.
 2. Blade material: 0.081" thick material. One piece aluminum extrusions with gutters designed to catch and direct water to jamb and mullion drains.
 3. Compression gaskets shall be provided between bottom of mullion or jamb and top of sill to insure leak tight connections.
 4. Frame Metal and Thickness: heads and sill 0.060" minimum; jambs 0.125" minimum.
 5. Louver Depth: 6 inches, unless otherwise indicated.
 6. Performance Requirements: As follows, determined by testing units 48 inches wide by 48 inches high per AMCA Standard 500:
 - a. Louver Free Area: Not less than 50% s.f.
 - b. Static Pressure Loss: Not more than 0.1 inch pressure drop at an airflow of 500 fpm free area intake velocity. Exhaust Pressure drop at the point of beginning water penetration 0.16 in. H₂O.
 - c. Water Penetration: Not more than 0.02 oz. per s.f. of free area at an airflow of 1100 fpm free area velocity when tested for 15 minutes.
 7. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
 8. Representative Product: Model 6177 by Construction Specialties.

2.5 BLANK-OFF PANELS

- A. General: Provide aluminum faced blank-off panels complying with the following requirements:
1. Aluminum Faced Blank-off Panels: Exterior Face to be Aluminum with same finish and color to match the aluminum louvers. Aluminum face shall be factory laminated to MDO (Medium Density Overlay) Board.
 2. Fabricate blank-off panels to sizes indicated.

2.6 LOUVER SCREENS

- B. General: Provide each exterior louver with louver screens complying with the following requirements:
1. Screen Location for Fixed Louvers: Interior face, unless otherwise indicated.
 2. Screening Type: Bird screening, unless otherwise indicated.
- C. Secure screens to louver frames with stainless steel machine screws, spaced at each corner and at 12 inch o.c. between.
- D. Louver Screen Frames: Fabricate screen frames with mitered corners to louver sizes indicated and to comply with the following requirements:

1. Metal: Same kind and form of metal as indicated for louver frames to which screens are attached.
 - a. Reinforce extruded aluminum screen frames at corners with clips.
 2. Finish: Same finish as louver frames to which louver screens are attached.
 3. Type: Rewireable frames with a driven spline or insert for securing screen mesh.
- E. Louver Screening for Aluminum Louvers: Fit aluminum louver screen frames with screening covering louver openings and complying with the following requirements:
1. Bird Screening: 1/2 inch square mesh formed with 0.080 inch diameter aluminum wire.

2.7 FINISHES, GENERAL

- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish louvers after assembly.

2.7 ALUMINUM FINISHES

- A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
- B. High-Performance Organic Coating: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
 1. Fluorocarbon 2-Coat Coating System: Manufacturer's standard 2-coat thermocured system, complying with AAMA 605.2, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight.
 2. Custom color.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions and directions for installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION

- A. Locate and place louver units plumb, level, and in proper alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

- E. Repair finishes damaged by cutting, welding, soldering, and grinding operations require for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make required alterations and refinish entire unit, or provide new units.
- F. Protect galvanized and nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metals.
- G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses where required to make louver joints weathertight. Comply with Section 07901 - Joint Sealants for sealants applied during installation of louver.

3.3 ADJUSTING AND PROTECTION

- A. Protect louvers and vents from damage of any kind during construction period including use of temporary protective coverings where needed and approved by louver manufacturer. Remove protective covering at time of Substantial Completion.
- B. Restore louvers and vents damaged during installation and construction period, so that no evidence remains of correction work. If results of restoration are unsuccessful, as judged by Architect, remove damaged units and replace with new units.
 - 1. Clean and touch-up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.
- C. Test operation of adjustable wall louvers and adjust as needed to produce fully functioning units which comply with requirements.

3.4 CLEANING

- A. Periodically clean exposed surfaces of louvers and vents, which are not protected by temporary covering, to remove fingerprints and soil during construction period; do not let soil accumulate until final cleaning.
- B. Before final inspection, clean exposed surfaces with water and with a mild soap or detergent not harmful to finishes. Rinse thoroughly and dry surface.

END OF SECTION 08 90 00

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 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.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior gypsum wallboard.
 - 2. Tile backing panels.

1.2 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 SUBMITTALS

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

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Gypsum Board and Related Products:

- a. American Gypsum Co.
- b. G-P Gypsum Corp.
- c. National Gypsum Company.
- d. United States Gypsum Co.

2.2 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Gypsum.
2. Georgia-Pacific Gypsum LLC.
3. Lafarge North America Inc.
4. National Gypsum Company; basis of design
5. USG Corporation.

- C. Gypsum Board: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

- D. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

- E. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch.
2. Long Edges: Tapered.

- F. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
 - 1. Thickness: 5/8 inch (15.9 mm).
 - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc, Plastic, Paper-faced galvanized steel sheet.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound; use at exposed panel edges.
 - c. L-Bead: L-shaped; exposed long leg receives joint compound; use where required.
 - d. Expansion (Control) Joint: Long flanges receive joint compound; use where required to relieve expansion/contraction at continuous planar runs in excess of allowable dimension and at crossings of building expansion/control joints. Confirm locations with Architect.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- 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 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 setting-type taping compound.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.6 ACOUSTICAL SEALANT

- A. As specified in Division 7 "Joint Sealants."
- B. For adhesives and sealants, indicate compliance with requirements for low-emitting materials.

2.7 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. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 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.

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. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum 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.
- E. 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.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Form control and expansion joints with space between edges of adjoining gypsum panels.

- I. Cover both faces of steel stud partition 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 open concrete coffers, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- J. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of 12 inches o.c. for vertical applications.
- K. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.3 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular 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 board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
- B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

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.

3.5 FINISHING GYPSUM BOARD ASSEMBLIES

- 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, 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, according to ASTM C 840, for locations indicated:
 - 1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.

END OF SECTION 09 29 00

SECTION 09 31 00 - CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Ceramic Floor Tile
 - 2. Ceramic Wall Tile including Base and Bullnose
- B. Related Sections include the following:
 - 1. Division 7 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
 - 2. Division 9 Section "Gypsum Board Assemblies" for substrates for ceramic tile.

1.3 DEFINITIONS

- A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.
- B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.4 PERFORMANCE REQUIREMENTS

- A. A. Dynamic Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ANSI 137.1, section 9.6:
 - 1. Level Surfaces: DCOF 0.42 Wet.
- B. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
 - 1. Level Surfaces: Minimum 0.6 Wet & Dry.

1.5 SUBMITTALS

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

- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches (300 mm) square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
 - 3. Full-size units of each type of trim and accessory for each color and finish required.
- E. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- F. Product Certificates: For each type of product, signed by product manufacturer.
- G. Qualification Data: For Installer.
- H. Material Test Reports: For each tile-setting and -grouting product.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
 - 1. Joint sealants.
 - 2. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
 - 1. Meeting Agenda to include, but is not limited to:
 - a. Tile and installation material compatibility.
 - b. Grouting Procedure.
 - c. Surface Preparation.
 - d. Maintenance and cleaning products and methods.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid latexes in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. 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.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
 2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
1. As selected by Architect from manufacturer's full range.
- D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- E. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 TILE PRODUCTS

CT-1

Manufacturer:	Daltile
Collection:	Volume 1.0 Glazed Porcelain with Stepwise Technology
Color:	Degrees Silver VL71
Size:	12" x 12"
Installation:	1/2 offset (see drawings)
Location:	Restroom Floors

CT-2

Manufacturer:	Daltile
Collection:	Linear Color Wheel Collection
Color:	Matte Arctic White 0790 (1)
Size:	4" x 12"
Installation:	Stacked (see drawings)
Location:	Field – Restroom Walls

CT-3

Manufacturer: Daltile
Collection: Linear Color Wheel Collection
Color: Semi-Gloss Arctic White 0190 (1)
Size: 4" x 12"
Installation: Stacked (see drawings)
Location: Accent - Restroom Walls

CT-4

Manufacturer: Daltile
Collection: Volume 1.0 Glazed Porcelain with Stepwise Technology
Color: Degrees Silver VL71
Size: 6" x 12"
Installation: Horizontal
Location: Restroom Cove Base

CT-5

Manufacturer: Daltile
Collection: Linear Color Wheel Collection
Color: Matte Arctic White 0790 (1)
Size: 4" x 12"
Installation: Horizontal
Location: Restroom Wall Bullnose

2.4 SETTING AND GROUTING MATERIALS

A. Available Manufacturers:

1. MAPEI Corporation, Basis of Design.
2. LATICRETE International Inc
3. Custom Building Products
4. Bonsal, W. R., Company
5. Bostik
6. DAP, Inc.

B. Dry-Set Portland Cement Mortar (Thin Set):

1. For wall applications, provide non-sag mortar that complies with ANSI A118.1

MAPEI Kerabond

C. Latex/Polymer Modified Portland Cement Mortar

1. For wall applications, provide non-sag, latex mortar that complies with ANSI A118.4

MAPEI Ultraflex 2

D. Large and Heavy Tile Mortar that complies with ANSI A118.4, A118.11

MAPEI Ultraflex LFT.

- E. Professional grade, ready to use, specialty grout. Meets and exceeds specific tests in ANSI A118.3 and A118.6. For grout joint widths of 1/16"-1/2"

MAPEI Flexcolor CQ

F. GROUT COLORS:

GR-1

Manufacturer: MAPEI

Color: To be selected from manufacturer's full range

Number: To be selected from manufacturer's full range

Location: CT-1 and CT-2C

GR-2

Manufacturer: MAPEI

Color: To be selected from manufacturer's full range

Number: To be selected from manufacturer's full range

Location: CT-2A, CT-2B, and CT-2D

2.5 SURFACE PREPARATION MATERIALS

- A. Reduced-preparation, self-leveling underlayment for smoothing and repairing interior floors before the installation of floor coverings from feather edge to up to 2" (5 cm).; MAPEI, "Ultraplan Easy"; Basis of Design.
1. 1 MAPEI Ultraplan 1 Plus
 2. MAPEI Primer T
- B. Cementitious Patching Compound; MAPEI, "Mapecem Quickpatch"; Basis of Design

2.6 CRACK ISOLATION AND WATERPROOFING MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 (Waterproofing) and A118.12 (Crack Isolation) for standard performance and is recommended by the manufacturer for the application indicated.
1. Corrugated Polyethylene: Corrugated polyethylene with dovetail-shaped corrugations and with anchoring webbing on the underside; 3/16-inch (4-mm) nominal thickness; Schluter Systems L.P DITRA and KERDI-BAND
 2. Liquid applied:
 - a. Premium Latex Based Waterproofing and Crack Isolation Membrane; fast setting, flexible, thin, load-bearing, waterproofing membrane system consisting of a premixed, quick-drying liquid latex, for installation under ceramic tile or complying with ANSI A118.10 and ANSI A118.12; and having IAMPO certification as a shower pan liner
 - b. MAPEI Mapelastic AquaDefense

Premixed, liquid-rubber, quick-drying crack-isolation membrane for installation under ceramic tile or stone in residential and commercial interior and exterior environments complying with ANSI A118.12 MAPEI Mapelastic CI

2.7 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. 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. Available Products:
 - a. Dow Corning Corporation; Dow Corning 786.
 - b. GE Silicones; Sanitary 1700.
 - c. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - d. Tremco, Inc.; Tremsil 600 White.
 - e. MAPEI Mapesil T; available in all 40 MAPEI grout colors

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. Temporary Protective Coating: Product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.
 - 1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.
 - 2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.
 - a. MAPEI Ultracare Grout Release.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

MAPEI Ultracare products:

1. Heavy Duty Stone, Tile and Grout Sealer
2. Concentrated Tile and Grout Cleaner
3. Everyday Stone, Tile and Grout Cleaner

2.9 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with [adhesives] [or] [thin-set mortar] that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.

2. Remove protrusions, bumps, and ridges by sanding or grinding.

- C. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: Where 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, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- 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. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
 - 2. Prepare joints and apply color sealants matching grout to comply with requirements in Division 7 Section "Joint Sealants.", at interior and exterior wall corners.
- H. Grout tile to comply with the manufacturer's requirements.
- I. Install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
- B. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.5 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- B. Joint Widths: Install tile on walls with the following joint widths:
 - 1. Porcelain Tile: 3/16 inch.

3.6 TILE BACKING PANEL INSTALLATION

- A. 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.

3.7 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.8 CRACK ISOLATION MEMBRANE INSTALLATION

- A. 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.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.9 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
 3. Remove temporary protective coating/grout release by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply 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.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 31 00

SECTION 09 63 40 - STONE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Dimension stone exterior flooring.
 - 2. Dimension stone stair treads.

1.2 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Shop Drawings: Include plans, sections, details, and attachments to other work.
- C. Samples:
 - 1. For each stone type indicated. Include at least four (4) or more Samples in each set and show the full range of color and other visual characteristics in completed Work.
 - 2. For each color of grout and pointing mortar required.
- D. Mock-Up: install mock-up area of 4'x4' for review and acceptance.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For stone flooring to include in maintenance manuals.

1.4 FIELD CONDITIONS

- A. Maintain air and material temperatures to comply with requirements of installation material manufacturers, but not less than 50 deg F during installation and for seven days after completion.
- B. Cold-Weather Requirements for Exterior Stone Flooring: Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- C. Hot-Weather Requirements for Stone Flooring: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602 and with the following:
 - 1. Maintain temperature of materials below 100 deg F.
 - 2. When the ambient temperature exceeds 90 deg F, fog spray installed stone flooring until damp at least three times a day until flooring is three days old.

PART 2 - PRODUCTS

2.1 LIMESTONE

- A. Material Standard: Comply with ASTM C568/C568M.
 - 1. Stone Abrasion Resistance: Minimum value of [10] <Insert value>, based on testing according to ASTM C241/C241M or ASTM C1353.
- B. Varieties and Sources: Limestone shall match existing removed limestone in color, finish, size, pattern and thickness.

2.2 MORTAR MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.]
 - 1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C114.
- B. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part of or all gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.
- C. Thinset Mortar:
 - 1. Verify existing original method used and proceed accordingly.
 - 2. Standard Dry-Set Mortar: ANSI A118.1.
 - 3. Modified Dry-Set Mortar: ANSI A118.4.
 - 4. Medium-Bed Modified Dry-Set Mortar: ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
 - 5. Improved Modified Dry-Set Mortar: ANSI A118.15.
- D. Water: Potable.

2.3 GROUT

- A. Grout Colors: Match stone grout.
- B. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate to produce required color.
- C. Standard Cement Grout: ANSI A118.6, packaged.
- D. Abrasive Inserts for Stair Treads: Abrasive strips consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder, fabricated for installing in routed grooves of stair treads to provide slip resistance. Provide epoxy-resin installation adhesive compatible with inserts.
- E. Cork Joint Filler: Preformed strips complying with ASTM D1752, Type II.

- F. Cleaner: Stone cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer and by sealer manufacturer]. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.
- G. Floor Sealer: Colorless, slip- and stain-resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

2.4 MORTAR AND GROUT MIXES

- A. Mortar: Comply with referenced standards and with manufacturers' written instructions to produce mortar of uniform quality and with optimum performance characteristics.
 - 1. Do not use admixtures unless otherwise indicated. Do not use calcium chloride.
 - 2. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding any water. Add only enough water to produce a damp, unworkable mix that retains its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches desired consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.
- B. Portland Cement-Lime Setting Mortar: ASTM C270, Proportion Specification Type S for exterior applications].
- C. Latex-Modified Portland Cement Setting Mortar: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions and to produce a stiff mixture with a moist surface when bed is ready to receive stone.
- D. Mortar-Bed Bond Coat: Mix neat cement and latex additive to a creamy consistency.
- E. Latex-Modified Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and latex additive to comply with latex-additive manufacturer's written instructions.
- F. Pointing Mortar: Comply with requirements indicated above for setting mortar, including type and the following:
 - 1. Pigmented Pointing Mortar: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1:10, by weight.
 - 2. Colored-Aggregate Pointing Mortar: Produce color required by combining colored aggregates with portland cement of selected color.
- G. Joint Grout: Comply with mixing requirements in referenced ANSI standards and with manufacturer's written instructions.

2.5 FABRICATION OF STONE

- A. Select stone for intended use to prevent fabricated units from containing cracks, seams, and starts that could impair structural integrity or function.
- B. Cut stone to produce pieces of thickness, size, and shape to match existing.
- C. Fabricate stone stair treads in sizes and profiles indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.
- B. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.
- C. 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 toward drains or away from walls.
- D. Before setting stone, clean dirty or stained stone surfaces by removing soil, stains, and foreign materials.

3.2 INSTALLATION, GENERAL

- A. Do necessary field cutting as stone is set. Cut lines straight and true, and finish field-cut edges to match shop-cut edges.
 - 1. Use power saws with diamond blades to cut stone except for stone that is specified to have rough-split edges.
- B. Scribe and field cut stone as necessary to fit at obstructions. Produce neat joints of size specified or indicated.
- C. Provide control and expansion joints of widths and at locations indicated. Keep control and expansion joints free of mortar, grout, and other rigid materials.

3.3 INSTALLATION TOLERANCES

- A. Variation in Joint Width: Do not vary from average joint width more than plus or minus 1/16 inch (1.5 mm) or one-fourth of nominal joint width, whichever is less.
- B. Variation in Surface Plane: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (10 mm) maximum from level or slope indicated.
- C. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/32-inch (0.8-mm) difference between planes of adjacent units.

3.4 INSTALLATION OF STONE BONDED TO CONCRETE

- A. Saturate concrete with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.
- B. Apply mortar-bed bond coat to damp concrete and broom to provide an even coating that completely covers the concrete. Do not exceed 1/16-inch (1.5-mm) thickness. Limit area of mortar-bed bond coat to avoid its drying out before placing setting bed.

- C. Apply mortar bed immediately after applying mortar-bed bond coat. Spread, tamp, and screed to uniform thickness at elevations required for setting stone to finished elevations indicated.
- D. Mix and place only that amount of mortar bed that can be covered with stone before initial set. Cut back, bevel edge, and discard material that has reached initial set before stone can be placed.
- E. Place stone before initial set of mortar occurs. Immediately before placing stone on setting bed, apply uniform 1/16-inch- (1.5-mm-) thick bond coat to mortar bed or to back of each stone unit.
- F. Tamp and beat stone with a wooden block or rubber mallet to obtain full contact with mortar bed and to bring finished surfaces within indicated tolerances. Set each unit in a single operation before initial set of mortar; do not return to areas already set and disturb stone for purposes of realigning finished surfaces or adjusting joints.
- G. Rake out joints to depth required to receive grout pointing mortar as units are set.
- H. Point joints after setting. Fill full with mortar type and color indicated. Tool joints flat, uniform, and smooth, without visible voids.
- I. Point joints after setting. Fill full with mortar type and color indicated. Tool joints flat, uniform, and smooth, without visible voids.

3.5 INSTALLATION OF STONE STAIR TREADS

- A. Install stone stair treads to comply with "Installation of Stone Bonded to Concrete" Article.

3.6 GROUTING

- A. Grout stone joints to comply with ANSI A108.10 and with manufacturer's written instructions.
 - 1. Do not use sanded grout for polished stone.
 - 2. Grout joints as soon as possible after initial set of setting bed. Force grout into joints, taking care not to smear grout on adjoining stone and other surfaces. After initial set of grout, finish joints by tooling to produce a slightly concave polished joint, free of drying cracks.

3.7 ADJUSTING AND CLEANING

- A. In-Progress Cleaning: Clean stonework as work progresses. Remove mortar fins and smears grout smears before tooling joints.
- B. Clean stonework after setting and pointing and grouting are complete. Use procedures recommended by stone fabricator for application types.
- C. Apply sealer to cleaned stonework according to sealer manufacturer's written instructions.

3.8 PROTECTION

- A. Prohibit traffic from installed stone for a minimum of 72 hours.
- B. Protect installed stonework during construction with nonstaining kraft paper. Where adjoining areas require construction work access, cover stonework with a minimum of 3/4-inch (20-mm) untreated plywood over nonstaining kraft paper.

END OF SECTION 09 63 40

SECTION 09 64 00 – ENGINEERED WOOD 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. Factory-finished pre-engineered wood flooring.
- B. Related Requirements:
 - 1. Section 03 “Cast in Place Concrete”

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor assembly and accessory. Include plans, sections, and attachment details. Include expansion provisions and trim details.
- C. Samples: For each exposed product and for each color and texture specified, approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.
- D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.
 - 1. Include Samples of accessories involving color and finish selection.
- E. Samples for Verification: For each type of wood flooring and accessory, with stain color and finish required, approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Wood Flooring: Equal to 1 percent of amount installed for each type, color, and finish of wood flooring indicated.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by the manufacturer.

1.6 WARRANTIES

- A. Commercial Warranties:
 - 1. 10-Year Structural Warranty
 - 2. 5-Year Finish warranty

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet-work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

1.8 FIELD CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
 - 1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
 - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
 - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
 - b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. MERCIER Flooring

1. 330 des Entrepreneurs street, Montmagny, Quebec Canada G5V 4T1
2. (418) 248-1785
3. Toll free: 1-866-448-1785

2.2 LOCAL SUPPLIER

- A. K&K Hardwood Floors
1. Address: 14514 Lee Road Suite G, Chantilly, VA 20151
 2. Phone: (703) 783-9597

2.2 FACTORY-FINISHED WOOD FLOORING

- A. Hardwood Strip Flooring
1. Species: To match existing
 2. Janka hardness (lb) (1 450),
 3. Grade: Select & Better
 4. Colors: As selected from manufacturer's full range of colors
 5. Width: To match existing
 6. Thickness: To match existing
 7. Top layer: Hardwood, 4 mm thick
 8. Base layer: Plywood.
 9. Lengths: Random, from 12" to 83" (305 mm to 2 108 mm)
 10. Edges: Micro v-joint on 4 sides
 11. Installation: Nailed
 12. Factory Finish: Generations Intact 2500 is composed of plant-based oil and microfrag-mented aluminum particles (AL2O3) in suspension in a UV-cured polyurethane resin.
- B. Additional Product Sustainability Requirements:
1. Manufactured without added urea-formaldehyde ASTM D-5116.
 2. Phtalate-free finish: OSHA method 104
 3. EPA TSCA Title VI compliant
 4. Maximum Greenguard Gold emission criteria

TVOC	≤ 0,22 mg/m ³
Formaldehyde	≤ 0,0073 ppm
Total Aldehydes	≤ 0,043 ppm
IVOCs	≤ 1/100 TLV and ½ chronic REL

2.3 CONCRETE SEALER

- A. Epoxy Sealer for Concrete Slabs: 2 Part Epoxy Sealer.

2.4 INSTALLATION METHODS

- A. Nailed per manufacturer's written instructions.

2.5 TRANSITIONS:

- A. Schluter ADA Transition.

2.6 ACCESSORY MATERIALS

- A. Trowelable Leveling and Patching Compound: Section 03 01 30 Flash Patching of Existing cast-In-Place Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Concrete Slabs: Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

3.2 PREPARATION

- A. Concrete Slabs:
 - 1. Grind high spots and fill low spots to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
 - 2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
 - 3. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- B. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Comply with flooring manufacturer's written installation instructions.
- B. Engineered-Wood Flooring: Nailed

3.4 PROTECTION

- A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.
 - 1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 64 00

SECTION 09 65 13 - RESILIENT WALL BASE AND 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. Resilient wall base.
 - 2. Accessories.
- B. Related Sections:
 - 1. Division 09 Section "Resilient Tile Flooring".

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

- A. Installation Qualifications: Contractors for floor covering installation should be experienced in managing commercial flooring projects and provide professional installers, qualified to install the various flooring materials specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products 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 or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products listed elsewhere in Part 2 by Tarkett North America or comparable products by one of the following manufacturers, but not limited to
 - a. Armstrong Flooring Inc.
 - b. Roppe Corporation USA.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 MATERIALS, GENERAL

- A. Emissions: Comply with emissions requirements of CDPH Standard Test Method.
- B. Bio-based Materials: Base with bio-based material per ASTM Test Method D6866 that is legally harvested and meeting the Sustainable Agriculture Network's Sustainable Agriculture Standard.
- C. Recycled Content: Provide products with recycled content.

2.4 RESILIENT WALL BASE (RB-1)

- A. Basis-of-Design Product: Tarkett Johnsonite Vinyl 1/8 (type TV).
 - 1. Product Standard: Meets performance requirements for ASTM F1861 Standard Specification for Resilient Wall Base, Type TV, Group 1.
 - 2. Profile: Traditional Toe Cove
 - 3. Height: 4"
 - 4. Thickness: 1/8"
 - 5. Type: TV
 - 6. Lengths: Cut lengths coils
 - 7. Outside Corners: Preformed
 - 8. Inside Corners: Job formed or preformed.
 - 9. Color: As selected from manufacturer's full range of colors
- B. Test Data:
 - 1. Resistance to light, ASTM F1515: Passes
 - 2. Resistance to chemicals, ASTM F925: Passes
 - 3. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm² or greater, Class 1.

2.5 RESILIENT MOLDING ACCESSORY

- A. Resilient Molding Accessory:
 - 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. Tarkett Johnsonite
 - b. Armstrong
 - c. Roppe
- B. Description: Transition strips as required where finish flooring differs in type and thickness
- C. Material: Rubber or Vinyl
- D. Profile and Dimensions: Full range of manufacturer's shapes and sizes

2.6 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), except that adhesive for rubber stair treads shall have a VOC content of 60 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products 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 products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible.
 - a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.
 - a. Miter or cope corners to minimize open joints.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 1. Remove adhesive and other blemishes from surfaces.
 2. Sweep and vacuum horizontal surfaces thoroughly.
 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.
 1. Apply manufacturer's recommended number of coats.
- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 19 - 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. Vinyl Composition Tile (VCT)

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: Full-size units of each color, texture, and pattern of floor tile required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 12 inches long, of each color required.
- C. Product Schedule: For floor tile.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following 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 or more than 95 deg F.
- 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 MANUFACTURERS

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products listed elsewhere in Part 2 by Armstrong Flooring, Inc. or approved equal.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.3 MATERIALS, GENERAL

- A. Resilient flooring installed within the building interior: Comply with emissions requirements of CDPH Standard Test Method.
- B. Bio-based Materials: Base with bio-based material per ASTM Test Method D6866 that is legally harvested and meeting the Sustainable Agriculture Network's Sustainable Agriculture Standard.
- C. Recycled Content: Provide products with recycled content.

2.4 VINYL COMPOSITION TILE (VCT)

- A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products listed below by Armstrong Flooring, Inc. or comparable products by one of the following manufacturers, but not limited to
 - 1. Tarkett North America
 - 2. Congoleum

VCT-1

Manufacturer: Armstrong
Collection: Excellon Imperial Texture
Pattern: To be selected from manufacturer's full range
Color: To be selected from manufacturer's full range
Size: 12" x 12"
Location: Entrance and Storage – Garden Cabin

VCT-2

Manufacturer: Armstrong
Collection: Excellon Imperial Texture
Pattern: To be selected from manufacturer's full range
Color: To be selected from manufacturer's full range
Size: 12" x 12"
Location: Mechanical Room 205 – 112 McCormick Cabin

2.5 INSTALLATION MATERIALS

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

PART 3 - EXECUTION

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. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing.
4. Moisture Testing: Perform tests so that each test area does not 1000 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
- 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 in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 1. Lay tiles in pattern of colors and sizes indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

- G. 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. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply manufacturer's recommended number of coats.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 91 00 - PAINTING

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 surface preparation and field painting of exposed exterior and interior items and surfaces.
 - 1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
- D. Related Sections include the following:
 - 1. Division 8 Section "Hollow Metal Doors and Frames"
 - 2. Division 9 Section "Gypsum Board Assemblies"

1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.4 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
 - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
 - 2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Samples for Initial Selection: For each type of finish-coat material indicated.
 - 1. After color selection, Architect will furnish color chips for surfaces to be coated.
- C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
 - 1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
 - 2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
- D. Qualification Data: For Applicator.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Benchmark Samples: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
 - 1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
 - a. Wall Surfaces: Provide samples on at least 100 sq. ft.
 - b. Small Areas and Items: Architect will designate items or areas required.
 - 2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
 - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
 - 3. Final approval of colors will be from benchmark samples.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep the storage area neat and orderly. Remove oily rags and waste daily.

1.7 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
 - 1. Benjamin Moore & Co. (Benjamin Moore)
 - 2. M. A. Bruder & Sons, Inc. (M. A. B. Paint).
 - 3. PPG Industries, Inc. (Pittsburgh Paints).
 - 4. Sherwin-Williams Co. (Sherwin-Williams), basis-of-design products and colors.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying the manufacturer's product identification will not be acceptable.
 - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction.
- D. Colors: As selected by Architect from manufacturer's full range.
 - 1. Anticipate up to 4 exterior colors and 8 interior colors for conventional paint products (refer to Finish Schedule). Ceilings to be flat finish, walls to be eggshell finish, and trim to be semi-gloss finish.

2.3 CONCRETE UNIT MASONRY BLOCK FILLERS

- A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
 - 1. Sherwin-Williams; Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils., Basis of Design.

2.4 EXTERIOR PRIMERS

- A. Exterior Wood Doors, Windows, Ceilings & Trim: Factory-formulated wood primer for exterior application.
 - 1. Sherwin-Williams; Exterior Latex Wood Primer B42W8041: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.
- B. Exterior Hard Wood Surfaces: Factory-formulated oil-based wood primer for exterior application.
 - 1. Sherwin-Williams; Exterior Oil Based Wood Primer Y24W8020: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.
- C. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
 - 1. Sherwin-Williams; Pro Industrial Pro-Cryl Universal Metal Primer B66-310: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

- D. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
 - 1. Sherwin-Williams; Pro Industrial Pro-Cryl Universal Metal Primer B66-310: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

2.5 INTERIOR PRIMERS

- A. New Wood: Factory-formulated latex-based primer for interior application.
 - 1. Sherwin-Williams; Premium Wall/Wood B28W8111. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.
- B. Old Wood: Factory-formulated latex-based primer for interior application.
 - 1. Sherwin-Williams; Adhesion Primer B51W8050. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.
- C. Plaster: Factory-formulated latex-based primer for interior application.
 - 1. Sherwin-Williams; Adhesion Primer B51W8050. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.
- D. Existing Plaster: Factory-formulated latex-based primer for interior application.
 - 1. Sherwin-Williams; Loxon Concrete/Masonry A24W8300. Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.
- E. Interior Concrete and Masonry Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
 - 1. Sherwin-Williams; Loxon Concrete & Masonry Primer B28W8300: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.
- F. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
 - 1. Sherwin-Williams; ProGreen 200 Latex Wall Primer B28W600 Series: Applied at a dry film thickness of not less than 1.1 mils., Basis of Design.
- G. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
 - 1. Sherwin-Williams; Pro Industrial Pro-Cryl Universal Metal Primer B66-310: Applied at a dry film thickness of not less than 3.0 mils., Basis of Design.

2.6 EXTERIOR FINISH COATS

- A. Exterior Wood Doors, Windows, Ceilings & Trim: Factory-formulated satin waterborne latex for exterior application.
 - 1. Sherwin-Williams; Exterior Super Paint A89 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils., Basis of Design.

- B. Exterior Semigloss Acrylic Enamel: Factory-formulated semigloss waterborne acrylic-latex enamel for exterior application.
 - 1. Sherwin-Williams; Pro Industrial 0 VOC Acrylic Semi-Gloss Coating, B66-650 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils., Basis of Design.

2.7 INTERIOR FINISH COATS

- A. Old & New Wood: Factory-formulated eggshell acrylic-latex interior enamel.
 - 1. Sherwin-Williams; ProGreen 200 Interior Latex Eg-Shel, B20Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.
- B. Old & New Plaster: Factory-formulated eggshell acrylic-latex interior enamel.
 - 1. Sherwin-Williams; ProGreen 200 Interior Latex Eg-Shel, B20Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.
- C. New Interior Gypsum Board Ceiling: Factory-formulated latex-based flat finish for interior application.
 - 1. Sherwin-Williams; ProGreen 200 Interior Latex Flat, B30Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.
- D. New & Old Painted Wood Floors: Factory-formulated finish for interior application.
 - 1. Sherwin-Williams; Armorseal Tread Plex B90 Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.
- E. Interior Low-Luster Acrylic Enamel: Factory-formulated eggshell acrylic-latex interior enamel.
 - 1. Sherwin-Williams; ProGreen 200 Interior Latex Eg-Shel, B20W650 Series: Applied at a dry film thickness of not less than 1.7 mils., Basis of Design.
- F. Interior Low-Luster Acrylic Enamel for Areas subject to Heavy Abrasion and Frequent Cleanings: Factory-formulated eggshell waterbased epoxy.
 - 1. Sherwin-Williams; Industrial Pre-Catalyzed Waterbased Epoxy Eg-Shel, K45W151 Series: Applied at a dry film thickness of not less than 1.5 mils., Basis of Design.
- G. Interior Semigloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.
 - 1. Sherwin-Williams; ProGreen 200 Interior Latex Semi-Gloss, B31W650 Series: Applied at a dry film thickness of not less than 1.5 mils., Basis of Design.
- H. Interior Semigloss Acrylic Enamel for Ferrous & Galvanized Metal: Factory-formulated semigloss acrylic-latex enamel for interior application.
 - 1. Sherwin-Williams; Pro Industrial 0 VOC Acrylic Semi-Gloss Coating, B66-650 Series: Applied at a dry film thickness of not less than 2.5-4.0 mils., Basis of Design.

2.8 INTERIOR WOOD STAINS AND VARNISHES

- A. Open-Grain Wood Filler: Factory-formulated paste wood filler applied at spreading rate recommended by manufacturer.
 - 1. Sherwin-Williams; Sher-Wood Fast-Dry Filler., Basis of Design.
- B. Clear Sanding Sealer: Factory-formulated fast-drying alkyd-based clear wood sealer applied at spreading rate recommended by manufacturer.
 - 1. Sherwin-Williams; Wood Classics Fast Dry Sanding Sealer B26V43, Basis of Design.
- C. Stain: Factory-formulated stain applied at spreading rate recommended by manufacturer.
 - 1. Sherwin-Williams; Wood Classics 250 VOC Satin, Basis of Design.
- D. Finish: Factory-formulated finish applied at spreading rate recommended by manufacturer.
 - 1. Sherwin-Williams; Wood Classics WB Poly A68F90 Satin, Basis of Design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Provide barrier coats over incompatible primers or remove and reprime.
 - 2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
 - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
 - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or another etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
 - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
 - c. If transparent finish is required, backprime with spar varnish.
 - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
 - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
 - 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
 - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
 - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
 - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.

5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 2. Provide finished coats that are compatible with primers used.
 3. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 4. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 5. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
 6. Paint the back sides of access panels and removable or hinged covers to match exposed surfaces.
 7. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 8. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
 9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to

- ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by the manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical items to be painted are specified to be painted in Division 15.
- F. Electrical items to be painted are specified to be painted in Division 16.
- G. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.
- K. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following test procedure at any time and as often as Owner deems necessary during the period when paint is being applied:
 - 1. Owner will engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of Contractor.
 - 2. Owner may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the Project site.
 - 1. After completing painting, clean glass and paint-splattered surfaces. Remove splattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After the work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
 - a. Primer: Exterior ferrous-metal primer.
 - b. Finish Coats: Exterior semigloss acrylic enamel.
- B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.

- a. Primer: Exterior galvanizad metal primer.
- b. Finish Coats: Exterior semigloss acrylic enamel.

3.8 INTERIOR PAINT SCHEDULE

- A. Concrete Unit Masonry: Provide the following finish systems over interior concrete masonry:
 - 1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a block filler.
 - a. Block Filler: Concrete unit masonry block filler.
 - b. Finish Coats: Interior low-luster acrylic enamel.
- B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
 - 1. Low-Luster Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior gypsum board primer.
 - b. Finish Coats: Interior low-luster acrylic enamel.
- C. Wood and Hardboard: Provide the following paint finish systems over new interior wood surfaces:
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a wood undercoater.
 - a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
 - b. Finish Coats: Interior semigloss acrylic enamel.
- D. Ferrous Metal: Provide the following finish systems over ferrous metal:
 - 1. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior ferrous-metal primer.
 - b. Finish Coats: Interior semigloss acrylic enamel.
- E. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
 - 1. Flat Acrylic Finish: Two finish coats over a primer.
 - a. Primer: Interior zinc-coated metal primer.
 - b. Finish Coats: Interior flat acrylic paint.
 - 2. Semigloss Acrylic-Enamel Finish: Two finish coats over a primer.
 - a. Primer: Interior zinc-coated metal primer.
 - b. Finish Coats: Interior semigloss acrylic enamel.
- F. All-Service Jacket over Insulation: Provide the following finish system on cotton or canvas insulation covering:
 - 1. Flat Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.

- a. Finish Coats: Interior flat latex-emulsion size.

3.9 PAINT SCHEDULE

PT-1

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: Typical Wall Paint

PT-2

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-3

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-4

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-5

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-6

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-7

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-8

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-9

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-10

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-11

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

PT-12

Manufacturer: Sherwin Williams
Color: TBD
Name: TBD
Sheen: TBD
Location: TBD

END OF SECTION 09 91 00

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 STIPULATIONS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior and Exterior panel signs.
 - 2. Signage accessories.
- B. Related Sections include the following:
 - 1. Division 23 Section "Mechanical Identification" for labels, tags, and nameplates for mechanical equipment.
 - 2. Division 26 Section "Electrical Identification" for labels, tags, and nameplates for electrical equipment.

1.3 SUBMITTALS

- A. Product Data: profiles and construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
 - 1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
- C. Samples for Initial Selection: For each type of sign material indicated that involves color selection.
- D. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
 - 1. Panel Signs: Full-size Samples of each type of sign required.
- E. Qualification Data: For Installer.
- F. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative of the signage manufacturer for installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.
 - 1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

1.7 WARRANTY

- A. Provide a warranty covering materials and workmanship for a period of 3 (three) years after 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. Interior Panel Signs, Basis-of-Design Product:
 - a. Mohawk Sign System MP 200 A Format or equal. The design for each sign is based on the product type named.
 - b. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 INTERIOR 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. Manufacturers:
 1. Basis of Design, Mohawk Sign Systems, Inc.
 2. Apco Signs
 3. ASI Modulex, Architectural Signage Solutions
 4. Best Sign Systems. Inc.
 5. InPro Corporation
 6. Signature Signs
 7. InVision Signs
- C. Laminated Sheet Sign. Sandblasted polymer face sheet with raised graphic laminated over subsurface graphics laminated over subsurface graphics to acrylic backing sheet to produce composite. Styles and types shall be as indicated in sketches and shall match Owner's interior signage standard prototype.
- D. Mounting for each sign style and type shall be as indicated in sketches/schedules.
- E. Cast-Acrylic Sheet: Manufacturer's standard and as follows:
 1. Color: As selected by Architect from manufacturer's full range.
 2. 1/16" Horizontal V Groove
 3. Thickness:
 - a. Static Signs: 1/4" Acrylic
 - b. Signs with Acrylic Window: milled edge creating a continuous U-shape frame to engage the acrylic Window.
- F. Before specifying, verify availability of plastic-laminate materials in color combinations required.
- G. Perimeter: Fabricate edges to profile indicated; comply with the following requirements for materials and corner conditions:
 1. Material: Romark or Equivalent.
 2. Corner Condition: sharp corners
- H. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.
- I. Graphic Symbols:
 1. Graphic symbols to meet code and ADA requirements.
 2. Color: As selected by Architect from Manufacturer's full range
- J. Acrylic Sheet Plastic Window: Plexiglass II by Rohm & Hass Co. or equal.
- K. Text Fonts: Sans Serif: Gill Sans, 3/4" high

- L. Blank Aluminum Sign Panels: To be used as a backer for mounting signs on window areas other than sidelights. At Doors with sidelights, sidelights are considered to be part of the door; sign to be mounted beside sidelight.
- M. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying 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
 - 2. Ball Pointed Braille.
 - 3. Raised-Copy Thickness: Not less than 1/32 inch.
- N. Accessories:
 - 1. Mounting Methods: Use concealed fasteners or double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.
- O. Adhesives: VOC Content of 70 g/L or less.
 - 1. For adhesives, indicating compliance with requirements for low-emitting materials.
 - 2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- P. Copy & Schedule:
 - 1. If there are any inconsistencies between the drawings and schedule
 - 2. Room names shall be changed through the shop drawings. Room number is for drawings and installation scheduling purpose and may not be included in the room signage or be changed.
 - 3. Provide Microsoft excel formatted spreadsheet, organized based on the signage schedule and modified per the mfg. means and methods for their production. This document is to be used to finalize copy with the user group in submittal process.

2.3 INTERIOR PANEL SIGN TYPES

- A. Type 1: ADA RESTROOM SIGN
 - 1. Universal Pictogram Symbol and Instructional Text.
 - 2. Size: 9.75" x 8.5"
 - 3. Mounting: Wall.
 - 4. Pictogram to include Men / Women and ADA

2.4 FINISHES, GENERAL

- A. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable

if they are within range of approved Samples and are assembled or installed to minimize contrast.

- C. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items provided under other sections of Work are sized and located to accommodate signs.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
 - 2. 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 (75 mm) of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
 - 1. All room numbers, nameplates, and room identification signs will be adhered to 1/8" thick finish PVC material (Sintra, Celtec, Komacel, Komatex, or equivalent) with 3M VHB Very High Bond Joining Systems #9473 double-sided tape (or equivalent). All signs to be mounted on block wall shall have the entire perimeter of the sign taped with 3M double sided tape #4432 (or equivalent).

3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

END OF SECTION 10 14 00

SECTION 10 28 00 - TOILET 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. This Section includes the following:
 - 1. Toilet accessories
 - 2. Underlavatory guards
 - 3. Grab bars
 - 4. Diaper Changing Station
- B. Related Sections include the following:
 - 1. Division 08 Section "Mirrors"

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. Setting Drawings: For cutouts required in other work; include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.
- D. Maintenance Data: For accessories to include in maintenance manuals specified in Division 1. Provide lists of replacement parts and service recommendations.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

1.5 COORDINATION

- A. See Toilet Accessories Schedule on drawings.

- B. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.6 WARRANTY

- A. General Warranty: Special warranty 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 General Contractor under requirements of the Contract Documents.
- B. Manufacturer's Warranty:
 - 1. Minimum Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers Names: Use of manufacturer's proprietary names to designate products is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers.
 - 1. Toilet Accessories:
 - a. Paper Towel Dispenser: Scotts Essential High Capacity Hard Roll Towel Dispenser, for 8" paper towel roll. #46253. NO SUBSTITUTIONS
 - b. Soap Dispenser: Gojo item #9034
 - c. Toilet Paper Holder: Jumbo Toilet Paper Dispenser SCA 56TR or Single Jumbo Roll Advantage PFTRD002601
 - d. Toilet Seat Cover Dispenser: Neat Seat, Half Fold / White Winco TSC10
 - e. Mirrors, see section 08 83 00 and interior elevations.
 - f. ADA grab bars; horizontal and vertical (see section 2.4).
 - g. Sanitary Napkin Disposal Unit: Rubbermaid model 6140
 - h. Wastepaper Disposal Unit: Rubbermaid 22 gallon trash can with push-in top
 - i. Baby Changing Station: Koala Kare KB300
 - 2. Underlavatory Guards:
 - a. Brocar Products, Inc.
 - b. Truebro, Inc.
 - c. Approved equal

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.
- B. Plastic: High-impact ABS grey plastic.

- C. Sheet Steel: ASTM A 366/A 366M, cold rolled, commercial quality, 0.0359-inch (0.9-mm) minimum nominal thickness; surface preparation and metal pretreatment as required for applied finish.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, G60 (Z180).
- E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electrodeposited on base metal.
- F. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- G. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed

2.3 DIAPER CHANGING STATION

- A. Surface Mounted Baby Changing Station:
 - 1. Diaper-changing station
 - 2. Basis of Design: Koala Kare Model KB300.
 - 3. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
Engineered to support minimum of 200-lb static load when opened.
 - 4. Mounting: Surface mounted, with unit projecting not more than 4 inches (102 mm) from wall when closed.
 - 5. Operation: By pneumatic shock-absorbing mechanism.
 - 6. Material and Finish: HDPE in manufacturer's standard color gray.
 - 7. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.4 GRAB BARS

- A. Stainless Steel Grab Bars: With snap flange covers:
 - 1. Satin Finish:
 - a. Basis of Design: Bobrick Model B-6806X18
 - 1) Length: 18 inches
 - b. Basis of Design: Bobrick Model B-6806X36
 - 1) Length: 36 inches
 - c. Basis of Design: Bobrick Model B-6806 x 42
 - 1) Length: 42 inches
 - 2. Compliance: Barrier-free accessibility guidelines (including ADAAG) for structural strength.
 - a. Capacity: Designed to support 900 lbs (408 kg) in compliant installations.
 - 3. Description: Clearance between grab bar and finished wall is 1-1/2 inches
 - 4. Grab Bar Materials: 18-8, Type 304, stainless steel tubing with satin finish.
 - 5. Grab Bar Construction: 18 gauge (1.2 mm), ends heliarc welded to flanges.
 - 6. Outside Diameter: 1-1/4 inch (32 mm).
 - 7. Mounting: Concealed with manufacturer's standard flanges and anchors.
 - 8. Minimum 0.05" thick, 1 1/2" outside diameter with manufacturer's standard slip-resistant texture. Concealed mountings shall have manufacturer's standard flanges and anchors. Install per ADAAG.

2.5 FABRICATION

- A. General: One, maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
- D. 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. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. 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 10 28 00

SECTION 10 44 16 - FIRE EXTINGUISHERS AND 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. This Section includes the following:
 - 1. Portable fire extinguishers.
 - 2. Brackets for wall hung units.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
 - 1. Fire Extinguishers: Include rating and classification.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide extinguishers listed and labeled by FM.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Portable Fire Extinguishers:

- a. J.L. Industries, Inc.
- b. Larsen's Manufacturing Company.
- c. Potter-Roemer; Div. of Smith Industries, Inc.
- d. Watrous; Div. of American Specialties, Inc.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

2.3 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.
- B. Multipurpose Dry-Chemical Type I: UL-rated 2-A:10:B:C, 5-lb nominal capacity, in enameled-steel container.

2.4 MOUNTING BRACKETS

- A. Mounting Brackets: Provide manufacturer's standard steel, designed to secure fire extinguishers to wall or structure, of sizes required for types and capacities of extinguishers indicated, with plated or baked enamel finish.
 - 1. Color: Red.
- B. Identification: Lettering complying with authorities having jurisdiction for lettering style, size, spacing, and location. Locate as indicated.
 - 1. Identify bracket-mounted extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - 2. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- C. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged units.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.

- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

END OF SECTION 10 44 16

SECTION 10 56 13 – METAL STORAGE SHELVING (FOUR-POST SHELVING AND ACCESSORIES)

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.
- B. Baltimore County Property Management's general requirements included in each bid package shall also apply to this Section. In case of conflict the more stringent document shall take precedence.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Four-post type metal shelving.
- B. Related Work, Not Furnished:
 - 1. Finish floor covering materials and installation.
- C. Related Sections:
 - 1. Sections in Division 9 – Finishes, relating to finish floor and base materials.

1.3 REFERENCES

- A. American National Standards Institute (ANSI) Standards:
 - 1. Applicable standards for fasteners used for assembly.
- B. American Society for Testing and Materials (ASTM) Standards:
 - 1. Applicable standards for steel sheet materials used for fabrication.
- C. American Institute of Steel Construction (AISC) Standards:
 - 1. Applicable standards for steel materials used for fabrication.

1.4 DESCRIPTION

- A. General: Four-Post Type Metal Shelving.
- B. Finishes:
 - 1. Fabricated Metal Components and Assemblies: All components to be painted with an electrostatically applied Powder Coat paint.
- C. Sizes: See Drawings for Shelf Numbers, and Elevations

1. Nature Cabin
2. Garage

1.5 SUBMITTALS

- A. Product Data: Submit manufacturer's product literature and installation instructions for each type of four-post shelving required. Include data substantiating that products to be furnished comply with requirements of the contract documents.
- B. Shop Drawings: Show fabrication, assembly, and installation details including descriptions of procedures and diagrams. Show complete extent of four-post shelving installation layout including quantities, locations and types of accessory units required. Include notations and descriptions of all installation items and components.
 1. Show installation details at non-standard conditions, if any.
 2. Provide layout, dimensions, and identification of each unit corresponding to sequence of installation and erection procedures.
 3. Provide installation schedule and complete erection procedures to ensure proper installation.
- C. Samples: Provide minimum 3 inch (76MM) square example of each color and texture on actual substrate for each component to remain exposed after installation.
- D. Selection Samples: For initial selection of colors and textures, submit manufacturer's color charts consisting of actual product pieces, showing full range of colors and textures available.
- E. Warranty: Submit draft copy of proposed warranty for review by the Architect.
- F. Maintenance Data: Provide in form suitable for inclusion in maintenance manuals for four-post shelving. Data shall include operating and maintenance instructions, parts inventory listing, purchase source listing, emergency instructions, and similar information.
 1. Submit manufacturer's instructions for proper maintenance materials and procedures.
 2. Submit manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against using materials and methods, which may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Engage an experienced manufacturer who is ISO 9001 certified for the design, production, installation and service of four-post shelving. Furnish certification attesting ISO 9001 quality system registration.
- B. Installer Qualifications: Engage an experienced installer who is a manufacturer's authorized representative for the specified products for installing four-post shelving.
 1. Minimum Qualifications: 1-year experience installing four-post shelving of comparable size and complexity to specified project requirements.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Follow manufacturer's instructions and recommendations for delivery, storage and handling requirements.

1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify quantities of four-post shelving units before fabrication. Indicate verified measurements on Shop Drawings. Coordinate fabrication and delivery to ensure no delay in progress of the Work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating four-post shelving units without field measurements. Coordinate construction to ensure actual dimensions correspond to established dimensions.

1.9 WARRANTY

- A. Provide a written warranty, executed by Contractor, Installer, and Manufacturer, agreeing to repair or replace units, which fail in materials or workmanship within the established warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have under General Conditions provisions of the Contract Documents.
- B. Limited Lifetime Warranty for Shelving: Subject to the terms in the written warranty, warrant the original purchaser exclusively that the shelving manufactured by it will be free from defects in materials and workmanship for the lifetime of the shelving.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Spacesaver Corporation
 - a. Basis-of-Design: Four-Post Shelving
 - 2. Or approved equal

2.2 BASIC MATERIALS

- A. General: Provide materials and quality of workmanship, which meets or exceeds established industry standards for products specified. Use furniture grade sheet metal, wood panels, plastic laminate and fasteners for component fabrication unless indicated otherwise. Material thicknesses/gauges are manufacturer's option unless indicated otherwise.

2.3 MANUFACTURED COMPONENTS

A. Design:

1. Wedge-lock type consisting of uprights, shelves, and shelf supports, designed to be assembled without fasteners or clips. Shelves shall not have any holes on exposed surfaces. Front and back flanges shall be flush with outside faces of posts. Design shall permit individual shelf adjustment and/or removal anywhere along the entire height of uprights.

B. Materials and Workmanship:

1. Fabricate units from Class 1, cold-rolled steel sheet with all bends sharp and true and no exposed "knife" edges.
 - a. All units shall be free of burrs, sharp edges and projecting hardware with smooth, non-abrasive surfaces and edges.
 - b. After fabrication, shelving shall exhibit no dents, "oil canning", buckling or other surface irregularities.

C. Uprights: Closed

1. Formed from steel sheet to a hollow "tee" shape for intermediate supports and formed angles for end supports. Uprights shall have keyhole slots on inner wall only. Provide with sheet steel panels full height and depth of end uprights. Provide intermediate "tee" uprights between adjacent units

D. Shelves:

1. Form from sheet steel with flanges on all sides and return hem on front and back flanges. Ends shall be formed to clear inside of upright offset panels. Shelves shall be independently adjustable. Provide all shelves with slots for file dividers.

E. Shelf Supports:

1. Form from heavy gauge steel sheet with four solid steel shoulder rivets, two per ear, that interlock with inner wall of uprights.

F. Nominal Shelf Dimensions: See drawings

G. Load Carrying Capabilities:

1. Provide shelf units capable of supporting 50 pounds per lineal foot (18kg/305MM) with maximum deflection of L/140. Shelves shall exhibit no permanent deflection under fully loaded conditions.

H. Accessories:

1. Full height backs: Provide manufacturer's standard steel back panels noted as "X" on drawings.
2. Bin Dividers: Provide manufacturer's standard removable dividers.
3. Support Rails: Provide support rails constructed of 14-gauge millimeter steel and interlock with the shelving interior attachment keyhole slots. Supports to be punched to accept heavy duty side supports.

2.4 FABRICATION

- A. General: Coordinate fabrication and delivery to ensure no delay in progress of the Work.

2.5 FINISHES

- A. Colors: Selected from manufacturer's standard available colors
- B. Paint Finish: Provide factory applied electrostatic powder coat paint. Meet or exceed specifications of the American Library Association.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine shelving units scheduled to receive accessories [with Installer present] for compliance with requirements for installation tolerances and other conditions affecting performance of specified accessory items.
- B. Proceed with accessory installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Follow manufacturer's written instructions for installation of each type of accessory item specified.

3.3 FIELD QUALITY CONTROL

- A. Verify accessory unit alignment and plumb after installation. Correct if required following manufacturer's instructions.
- B. Remove components that are chipped, scratched, or otherwise damaged and which do not match adjoining work. Replace with new matching units, installed as specified and in manner to eliminate evidence of replacement.

3.4 ADJUSTING

- A. Adjust all accessories to provide smoothly operating, visually acceptable installation.

3.5 CLEANING

- A. Immediately upon completion of installation, clean components and surfaces. Remove surplus materials, rubbish and debris resulting from installation upon completion of work and leave areas of installation in neat, clean condition.

3.6 DEMONSTRATION/TRAINING

- A. Schedule and conduct demonstration of installed accessory items and features with Owner's personnel.
- B. Schedule and conduct maintenance training with Owner's maintenance personnel. Training session should include lecture and demonstration of all maintenance and repair procedures that end user personnel would normally perform.

3.7 PROTECTION

- A. Protect system against damage during remainder of construction period. Advise Owner of additional protection needed to ensure that system will be without damage or deterioration at time of substantial completion.

END OF SECTION 10 56 13

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

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 and the other sections of Division 22.
- B. Motors shall comply with Division 23 Section - "Common Motor Requirements".
- C. Variable Frequency Drives shall comply with Division 23 Section - "Variable Frequency Drives".

1.2 SUMMARY

- A. Section includes:
 - 1. General administrative and procedural requirements, as well as the following basic plumbing materials and methods.
 - 2. Submittals.
 - 3. Record documents.
 - 4. Operation and Maintenance manuals.
 - 5. Rough-ins.
 - 6. Plumbing installations.
 - 7. Cutting and patching.
 - 8. Concrete equipment base construction requirements.
 - 9. Equipment nameplate data requirement.
 - 10. Labeling and identifying mechanical systems and equipment is specified in Division 22 Section "Identification for Plumbing Piping and Equipment."
 - 11. Non-shrink grout for equipment installations.
 - 12. Field-fabricated metal and wood equipment supports.
 - 13. Installation requirements common to equipment specification Sections.
 - 14. Plumbing demolition.
 - 15. Touchup painting and finishing.

1.3 ACRONYMS

- A. The following list of abbreviations are utilized within the specifications and are provided as a reference:
 - 1. ADA - American Disability Act
 - 2. AGA - American Gas Association
 - 3. ANSI - American National Standards Institute
 - 4. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers

COMMON WORK RESULTS FOR PLUMBING

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5.	ASME	-	American Society of Mechanical Engineers
6.	ASTM	-	American Society for Testing and Materials
7.	AWS	-	American Welding Society
8.	AWWA	-	American Water Works Association
9.	IBC	-	International Building Code
10.	CS	-	Commercial Standard
11.	CSA	-	Canadian Standards Association
12.	IBR	-	Institute of Boiler and Radiator Manufacturers
13.	IEEE	-	Institute of Electrical and Electronics Engineers
14.	IMC	-	International Mechanical Code
15.	IPC	-	International Plumbing Code
16.	MOSHA	-	Maryland Occupational Safety and Health Administration
17.	MSSP	-	Manufacturers Standards Society of the Valve and Fittings Industry
18.	NEC	-	National Electrical Code
19.	NEMA	-	National Electrical Manufacturers Association
20.	NFPA	-	National Fire Protection Association
21.	OSHA	-	Occupational Safety and Health Administration
22.	SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
23.	TEMA	-	Tubular Exchanger Manufacturers Association
24.	UL	-	Underwriters' Laboratories

1.4 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term product includes the terms material, equipment, system, and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes proposed by Contractor in products, materials, equipment, and methods of construction required by the Contract Documents.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named, or a product is accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. Extended Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.5 SYSTEM DESCRIPTION

- A. Design Requirements: Contract drawings are generally diagrammatic and do not indicate all offsets, fittings, transitions, access panels and other specialties required.
 - 1. Furnish and install all items as may be required at no additional cost to fit the work to the conditions encountered.
 - 2. Arrange piping, equipment and other work generally as shown on the contract drawings, providing proper clearances and access.
 - 3. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawing submittal for approval in accordance with Submittals specified below.
 - 4. Subject to the provisions of Division 01, Architect may make reasonable changes in location of equipment piping and ductwork up to the time of rough-in or fabrication.

1.6 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Shop Drawings and Product Data:
 - 1. Clearly identify all submittals:
 - a. Indicate intended application, location, etc.
 - b. Each submittal shall indicate the associated specification section, and paragraphs. Do not combine product data and shop drawing submittals from different spec sections into a single submittal package, even though they may be the same distributor, vendor or part of a single material order.
 - c. Clearly indicate the exact type, model number, size and special features of the proposed item.
 - d. Include catalog spec sheets to completely describe proposed equipment.
 - e. Factory order forms only showing the required capacities are not acceptable.
 - f. Identify all options furnished to meet specifications.
 - g. If product is within system supplying fixture intended to dispense potable water for human consumption, including drinking and cooling, submittals shall indicate that product is "lead free", containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
 - h. Solder and flux for soldered joints in potable water piping shall be "lead free", containing not more than 0.2% lead.
 - i. The Architect shall not select equipment ratings and/or options. Submittals not properly marked shall be returned without review.

- C. Product Substitutions: Comply with requirements of Division 01.
- D. Comparable Products Submission:
 - 1. Document each request for a proposed comparable product with supporting data substantiating compliance of proposed product with Basis-of-Design product.
 - 2. Use the attached "Comparable Product Submittal Form" in addition to the requirements specified herein.
 - 3. Comparable products will not be reviewed without completion of the attached form.
- E. Closeout Submittals:
 - 1. Record Drawings: Prepare record documents in accordance with the requirements in Division 01 Section: "Execution and Closeout Requirements" In addition to the requirements specified in Division 01, indicate the following installed conditions:
 - a. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 22 Section: "Identification for Plumbing Piping and Equipment". Indicate actual inverts and horizontal locations of underground piping.
 - b. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - c. Approved substitutions, Contract Modifications, Responses to Contractor's Request for Information, and actual equipment and materials installed.
 - d. Record the locations and invert elevations of underground installations.
 - 2. Operation and Maintenance Data: Prepare operation and maintenance data in accordance with Division 01 Section: "Execution and Closeout Requirements". In addition to the requirements specified in Division 01, include the following information for equipment items:
 - a. List of systems and equipment requiring service manuals.
 - b. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - c. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - d. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - e. Servicing instructions and lubrication charts and schedules.
 - f. Systems and Equipment test reports.
 - 3. Commissioning Report
- F. Color Selection: Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.
- G. Products and Materials:
 - 1. Submit complete descriptive data for all materials as follows:

- a. Material specifications.
 - b. Data sheets.
 - c. Samples.
 - d. Capacity ratings.
 - e. Performance curves.
 - f. Operating characteristics.
 - g. Catalog cuts.
 - h. Dimensional drawings.
 - i. Wiring diagrams.
 - j. Lead Free, for potable water service.
 - k. Installation instruction.
 - l. Any other information necessary to indicate compliance with contract documents.
 2. Edit submittal data specifically for application to this project.
 3. Submit actual operating conditions and characteristics for all equipment.
 4. Catalogs or catalog cuts are not acceptable unless the particular item and all relative data has been marked in such a manner as to be clearly defined.
 5. Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.
 6. No plumbing item shall be fabricated, purchased, delivered to the site or installed, until reviewed by the Architect.
 - a. After the proposed materials have been approved, no substitution will be permitted except where approved by the Architect.
 7. Provide shop drawing and product data submittals as indicated under individual specification sections.
 8. Provide any other equipment requested by the Architect.
- H. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.7 QUALITY ASSURANCE

- A. Underwriter's Laboratory (UL) Requirements: All equipment containing electrical components and provided under Division 22 shall bear the Underwriter's Laboratory (UL) label, as a complete packaged system.
1. Equipment not provided with a UL label shall be tested in the field, certified and provided with a listed label at the installer's expense.
 - a. Field testing shall be performed by a testing agency approved by the authority having jurisdiction.
 - b. Provide services of a UL recognized, independent Electrical Testing Laboratory (ETL) to provide field inspection and testing. Provide and ETL Label on all such equipment.
- B. Fire Safe Materials: Unless otherwise indicated, materials shall conform to UL, National Fire Protection Agency (NFPA) or American Society for Testing and Materials (ASTM) standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.
- C. All plumbing products and materials shall be listed by a third party certification agency.

COMMON WORK RESULTS FOR PLUMBING

1. Each length of pipe and each pipe fitting, trap, fixture, material and device utilized in a plumbing system shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Division 01 Section: "Product Requirements:"

1. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
2. Schedule delivery to minimize long-term storage at Project Site and to prevent overcrowding of construction spaces.
3. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
4. Deliver products to Project Site in 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.
5. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
6. Store products in manner that will facilitate inspection and measurement.
7. Store materials in a manner that will not endanger project structure.
8. Store products subject to damage by elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation.
9. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather protection requirements for storage.

1.9 PROJECT CONDITIONS

A. Existing Conditions: Prior to preparing the bid, visit the site and become familiar with all existing conditions. Make all necessary investigations as to locations of utilities and all other matters, which can affect the work. No additional compensation will be made for failure to determine the conditions under which the work will be performed.

B. Outages

1. All plumbing outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon with the Owner.
2. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled with the Owner at least fourteen days (14) days in advance. All such outages shall be performed on other than normal work hours, Monday through Friday 8 a.m. to 5 p.m.
3. The bid price shall include the cost of all premium time required for outages and other work which interferes with the normal use of the building.
4. The operation of valves or switches required to achieve an outage shall be accomplished by the Owner. Unauthorized operation of valves, power switches, or other control devices shall not be permitted.

1.10 SEQUENCING

- A. Coordinate plumbing equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for plumbing installations.
- C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- E. Coordinate connection of electrical services.
- F. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- G. Coordinate requirements for access panels and doors where plumbing items requiring access are concealed behind finished surfaces.
- H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.11 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include project-specific information and properly executed.
 - 2. Refer to Divisions 01 through 26 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section: "Execution and Closeout Procedures."

1.12 DISCREPANCIES

- A. Where discrepancies occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included

in the contract price. The Architect shall decide on the item and manner in which the work shall be provided, based on the design intent of the documents.

1.13 SPECIAL TOOLS & OPERATING ACCESSORIES

- A. Wherever any products provided under this Division have tamperproof, special or restrictive hardware, as specified or where provided from the manufacturer as standard or optional construction, provide a minimum of two (2) matching tools, bits, sockets, etc. needed for operation and/or access to such items. This shall include, but is not limited to:
1. Tamperproof screws, bolts, etc. on devices, enclosures, covers, etc.
 2. Penta-head bolts used on handhole and/or manhole lids.
 3. Penta-head bolts used on switchgear, transformers, etc.
 4. Any other special tools which are unique to that product.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with Contract Documents that are undamaged and new at time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Where products are accompanied by the term as selected, Architect will make selection.
 4. Where products are accompanied by the term match sample, sample to be matched is Architect's.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. General Compliance Requirements: Compliance requirements for individual products, as indicated in Contract Documents, are multiple in nature and may include generic descriptions, performance requirements, compliance with reference standards, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with.
- C. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Document requirements, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.
- D. Products specified by Reference Standards, Codes and Regulations: Select from among products, which can be shown to comply with referenced documents.

- E. Products specified by Naming Products and Manufacturers: Select from among products listed.
- F. Products specified by Naming One Manufacturer's Product as the Basis-of-Design with Reference to Other Manufacturers: Select either the specified Basis-of-Design product or an approved comparable product by one of the other named manufacturers.
 - 1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named manufacturers.
- G. Products specified by Naming One Manufacturer's Product and Indicating Option of Selecting Comparable Products by stating or Approved Equivalent or similar language: Select either the specified product or an approved comparable product.
 - 1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named or un-named manufacturers.
- H. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and, matches Architect's sample. Architect's decision will be final on whether proposed product matches satisfactorily.
- I. Visual Selection Specification: Where Specifications include the phrase as selected from manufacturer's standard colors, patterns, textures or similar phrase, select a product that complies with other specified requirements. Architect will select color, pattern, and texture.
 - 1. Standard Range: Where Specifications include the phrase standard range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - 2. Full Range: Where Specifications include the phrase full range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Where Basis-of-Design products are specified by name, submit the following, in addition to other required submittals, to obtain approval of a comparable product by one of the named manufacturers:
 - 1. Evidence that the proposed product does not require extensive 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 the Basis-of-Design product in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, serviceability, 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.

2.3 GROUT

- A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B, "Packaged Dry, Hydraulic-Cement Grout (Nonshrink)", "latest edition".
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory-packaged.

2.4 ACCESS DOORS AND PANELS

- A. Provide manufactured steel door assemblies consisting of:
 - 1. Hinged door.
 - 2. Flush screwdriver camlocks and frame.
- B. Doors shall be Milcor Metal Access doors. Provide key locks where indicated.
- C. Design shall be provided for the following installations:
 - 1. Masonry or Dry Wall: Style M.
 - 2. Hard Finish Plaster: Style AP.
 - 3. Fire rated dry wall ceilings: Style CFRAD, 1 hour combustible floor ceiling system, 1 hour non-combustible floor ceiling system, 3 hour non-combustible floor ceiling system.
 - 4. Suspended ceilings: Style CT.
 - 5. Security: Style 3211.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Interface With Site Utility Companies:
 - 1. Contact MISS UTILITY prior to any excavation or underground work.
 - 2. Contact local utility companies (gas, water, sewer, etc.) immediately upon award of contract. Do not install related equipment until fully coordinated with appropriate utilities.
 - 3. Provide all construction schedules, dates of requested services, outage windows, equipment locations, etc. necessary for utility work.
 - 4. Gas Utility:
 - a. Coordinate service entrance equipment and related layout with gas company prior to ordering or installing any equipment or systems.
 - b. Furnish and install all incoming concrete pads, sleeves, connections, etc.
 - 5. Water and Sewer Utilities:
 - a. Coordinate flow, usage and pressure requirements with local water and sewer authorities as necessary to obtain services.

COMMON WORK RESULTS FOR PLUMBING

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3.2 INSTALLATION

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
 6. Where systems, materials and equipment are intended for overhead installation, and where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
 10. Install plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 11. Install access panel or doors where units or valves are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section: "Access Doors and Frames" and within this section.
 12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- B. Rough-In
1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 2. Refer to equipment specifications in Divisions 01 through 26 for rough-in requirements.
- C. Housekeeping and Equipment Pad
1. Construct pads of dimensions indicated, but not less than 4 inches larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for

anchor bolt and tie locations. Use 3000-psi,, 28-day compressive strength concrete and reinforcement bars as specified in Division 03 Section: "Cast-in-Place Concrete".

D. Erection of Metal Supports and Anchorage

1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
2. Field Welding: Comply with AWS D1.1, "Structural Welding Code -Steel", 2001.

E. Erection of Wood Supports and Anchorage

1. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
2. Select fastener sizes that will not 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 members.
3. Attach to substrates as required to support applied loads.

F. Grouting

1. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
2. Clean surfaces that will come into contact with grout.
3. Provide forms for placement of grout, as required.
4. Avoid air entrapment when placing grout.
5. Place grout to completely fill equipment bases.
6. Place grout on concrete bases to provide a smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout according to manufacturer's printed instructions.

G. Lintels

1. Lintels shall be provided for openings in masonry, brick, concrete, etc. walls to accommodate work of this division.
 - a. Lintels shall be provided under this division when not being provided under other divisions. Lintels shall be approved by the Architect.

H. Pex Parallel Water Distribution Bundling

1. Piping Bundles for manifold systems shall be supported per plumbing code. Support at changes in direction shall be in accordance with the manufacturer's instructions.

3.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 01 Section: "Execution and Closeout Requirements". In addition to the requirements specified in Division 01, the following requirements apply:

COMMON WORK RESULTS FOR PLUMBING

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1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective Work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- F. Patch finished surfaces and building components using new materials specified for the original installation and using experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

3.4 PAINTING AND FINISHING

- A. Division 09 Section: "Painting and Coating" for field painting requirements.
- B. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Do not paint manufacturer's labels or tags.

3.5 PLUMBING DEMOLITION

- A. Disconnect, demolish, and remove work specified under Division 22 and as indicated. Remove pipes and ducts back to the active pipe and duct to remain and cap.
- B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.

- D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches (50 mm) beyond the face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from the Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

3.6 PENETRATION OF WATERPROOF CONSTRUCTION

- A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls and interior waterproof construction.
- B. Furnish and install drains, curbs, vent assemblies, sleeves, flashing, etc. specifically designed for application to the particular construction. Install system in accordance with the roofing manufacturer's instructions.

3.7 EXCAVATION AND BACKFILLING

- A. General
 - 1. Perform all necessary excavation, for installation of work under Division 22, in accordance with Division 31.

3.8 CLEANING

- A. Clean surfaces prior to application of insulation, adhesives, coating, and paint.
- B. Provide factory applied finish where specified.
- C. Protect all finishes, and restore all finishes to their original condition if damaged as a result of work under Division 22.
- D. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces.
- E. General: General cleaning during construction is required by the General Conditions and included in Section Temporary Facilities.
- F. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- G. Remove all plumbing clipping, wiring, nuts, bolts, etc. left on top of ceilings and ceiling tiles.

3.9 PROTECTION

- A. Protect work, material and equipment from weather and construction operations before and after installation.
- B. Properly store and handle all materials and equipment.
- C. Cover temporary openings in piping, ductwork and equipment to prevent the entrance of water, dirt, debris, and other foreign matter.

3.10 LUBRICATION

- A. All bearings, motors and all equipment requiring lubrication shall be provided with accessible fittings.
- B. Before turning over the equipment to the Owner, provide the following:
 - 1. Fully lubricate each item of equipment.
 - 2. Provide 1 year's supply of lubricant for each type of lubricant.
 - 3. Provide complete written lubricating instructions, together with diagram locating the points requiring lubrication.
- C. Motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal extended grease fittings and drain plugs.

3.11 ELECTRICAL WORK

- A. It is the intent to provide a complete and operational system. The work between Division 22 and 26 is complementary and is meant to produce a single and operating system. Contractor shall make its own determination as to the distribution of responsibility among the various trades.
- B. All electrical work performed under Division 22 shall be provided in accordance with Division 26.

3.12 PROVISIONS FOR ACCESS

- A. Furnish and install adequate access to all plumbing components. The following list shall be used as a guide only:
 - 1. Plumbing equipment.
 - 2. Valves.
 - 3. Cleanouts.
 - 4. Traps.

- B. Access shall be adequate as determined by the Architect.
- C. Refer to contract drawings where panels have been specifically located.
- D. Provide additional panels for adequate access as indicated in paragraph A above.
- E. Where access is by means of liftout ceiling tiles or panels mark each panel using small color-coded or numbered tabs. Provide an index chart for identification. Place markers in corner of tile.

3.13 OPERATION OF EQUIPMENT

- A. Clean all systems and equipment prior to initial operation for testing and balancing.
- B. Do not operate equipment unless all proper safety devices or controls are operational.
- C. Provide all maintenance and service for equipment, which is operated during construction.
- D. Where specified and otherwise required, provide the services of a manufacturer's factory trained service organization to start the equipment.
- E. Do not use mechanical systems for temporary services during construction unless authorized in writing by the Architect.
 - 1. Where such authorization is granted, temporary use of equipment shall not limit or otherwise affect warranties or guarantees of the work.
- F. Upon completion of work, clean and restore all equipment to new conditions and replace all filters.

3.14 DEMONSTRATION

- A. Demonstrate operation and maintenance of equipment and systems to Owner's personnel a minimum two (2) weeks prior to date of final inspection.
 - 1. For equipment requiring seasonal operation, perform instructions for other seasons at the same time.
 - 2. Training period shall be performed within 1 - two week period.
- B. Use operation and maintenance manuals and video as basis of instruction. Review contents of manual and video with personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate the following:
 - 1. Start up.
 - 2. Operation.
 - 3. Control.
 - 4. Adjustment.

5. Trouble shooting.
6. Servicing.
7. Maintenance.
8. Shutdown.

D. Provide at least 40 hours straight time instruction to the operating personnel.

1. This instruction period shall consist of not less than five-8 hour days.
2. Time of instruction shall be designated by the Owner.
3. This instruction shall be in addition to instructional requirements of specific equipment specified elsewhere in Division 22.

3.15 WALL AND FLOOR PENETRATION

- A. All penetrations of partitions, walls and floors by ducts, piping or conduit under Division 22 shall be sealed and caulked. Provide U.L. listed fire stopping systems at penetrations through fire rated walls.
- B. Sealing of Annular Spaces at Penetrations.
1. The annular spaces between the outside of a pipe and the inside of a pipe sleeves, or between the outside of a pipe and an opening in a building envelope wall, floor, or ceiling assembly penetrated by a pipe shall be sealed in an approved manner with caulking material or closed with a gasketing system. The caulking material, foam sealant, or gasketing system shall be designed for the conditions at the penetration location and shall be compatible with the pipe, sleeve and building materials in contact with the sealing materials. Annular spaces created by pipes penetrating fire resistance-rated assemblies or membranes of such assemblies shall be sealed or closed in accordance with the International Building Code.

3.16 EQUIPMENT PROVIDED UNDER ANOTHER DIVISION AND BY OTHERS

- A. Make all system connections required to equipment furnished and installed under another division and by others.
- B. It shall be the responsibility of the Contractor to coordinate all necessary data from the equipment supplied under other Divisions.

3.17 MECHANICAL EQUIPMENT SERVICE PLATFORMS

- A. Where mechanical equipment is located on a roof or elevated structure that requires access such that personnel will have to climb over ductwork or higher than 16 feet above grade to access the equipment, a means to access the equipment shall be provided.
- B. Provide catwalks around the entire perimeter of equipment to match manufacturer required clearance area. Minimum 36" from perimeter of unit.
- C. Provide side edge railings that extend above the catwalk not less than 30" above the catwalk.

3.18 PROJECT PUNCH OUT

- A. Architect/Engineer will perform punch out reviews and will provide the Contractor with a list of punch list items to be completed before contract close out. Each and every punch list item shall be initialed and dated by the Contractor when the work is complete. The Architect/ Engineer will not perform any punch list verification until all items have been completed, initialed, dated and the list returned to the Architect/Engineer. If any items have been initialed as being completed by the Contractor and the Architect/Engineer determines that the work is not complete, the Architect/Engineer shall be reimbursed by the Contractor at his regular hourly rate for any and all items requiring revisiting of the site by the Architect/Engineer. Reimbursement will be made by deducting the Architect/Engineer fee from the Contractor's final payment.

END OF SECTION

SECTION 22 05 03
PIPES AND TUBES 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, and all sections of Division 22.

1.2 SUMMARY

- A. Section includes:

1. Domestic Cold, Hot, and Circulating Hot Water (Potable and Non-Potable)
2. Sanitary, Sanitary Vent, and Storm Water
3. Air Conditioning Condensate, Equipment Drains, and Overflows
4. Piping Specialties and Accessories.
5. Point of Use Solids Interceptor

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

1. Division 03 Section: "Cast-In-Place Concrete": Product and execution requirements for formwork, reinforcement, and concrete specified by this section.
2. Division 07 Section: "Firestopping" – For Opening Protection: Product and execution requirements for penetration through fire rated construction, and smoke seal protection specified by the section.
3. Division 07 Section: "Sheet Metal Flashing and Trim: Product and execution requirements for custom fabricated roof and wall flashings and roof drainage systems.
4. Division 08 Section: "Access Doors and Frames" for project requirements for access doors for placement by this section.
5. Division 09 Section: "Painting and Coating": Product and execution requirements for painting specified by this section.
6. Division 22 Section: "Common Work Results for Plumbing": Product and execution requirements for common work results for plumbing for placement specified by this section.
7. Division 22 Section: "Expansion Fittings and Loops for Plumbing Piping": Product requirements for piping expansion compensation devices for placement by this section.
8. Division 22 Section: "Hangers and Supports for Plumbing Piping and Equipment": Product requirements for pipe hangers and supports for placement specified by this section.
9. Division 22 Section: "Plumbing Piping System Cleaning and Treatment": Product and execution requirements for system cleaning and treatment specified by this section.
10. Division 22 Section: "Vibration and Seismic Controls for Plumbing Piping and Equipment": Product requirements for vibration isolation for placement specified by this section.

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

11. Division 22 Section: "Plumbing Insulation": Product requirements for piping insulation for placement specified by this section.
12. Division 22 Section: "General – Duty Valves for Plumbing Piping": Product requirements for valves for placement specified by this section.
13. Division 31 Section: "Soils for Earthwork": Soils for backfill in trenches.
14. Division 31 Section: "Aggregates for Earthwork": Aggregates for backfill in trenches.
15. Division 31 Section: "Excavation": Product and execution requirements for excavation and backfill required by this section.
16. Division 31 Section: "Trenching": Execution requirements for trenching for underground piping systems.
17. Division 31 Section: "Fill": Execution requirements for backfilling required by this section.

1.3 DEFINITIONS

- A. Point of Delivery is the outlet of the service meter assembly, or the outlet of the service regular (service shutoff valve when no meter is provided).
- B. Domestic Water Systems: A system conveying domestic potable or non-potable water, such as Cold Water, Hot Water, Hot Water circulating, etc.
- C. Gravity Drainage Systems: A system of gravity fed effluent conveying storm water, sanitary, and laboratory acid waste, etc.
- D. Lead Free:
 1. The pipes, pipe fittings, plumbing fittings or fixtures in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooking, shall be "lead free", containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
 2. Solder and flux for soldered joints in potable water piping shall be "lead free", containing not more than 0.2% lead free.
- E. Pex Piping: Cross Linked Polyethylene, it is made from Cross Linked Hope (High Density Polyethylene), it is melted and continuously extruded into tubing.
- F. CPVC Piping: Chlorinated Polyvinyl Chloride thermoplastic pipe is made by the chlorination of PVC resin and extruded into pipe that meets FBC chemical compatibility

1.4 REFERENCES

(Unless otherwise noted, references apply to “latest editions.”)

A. ANSI (American National Standards Institute)

1. ANSI B16.39, Malleable Iron Threaded Pipe Unions.
2. ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
3. ANSI/ASME B16.3, Malleable Iron Threaded Fittings.
4. ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.
5. ANSI/ASME B16.21, Non-metallic Flat Gaskets for Pipe Flanges.
6. ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
7. ANSI/ASME B16.29, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV).
8. ANSI/API 600, Bolted Bonnet Steel Gate Valves for Petroleum and Natural Gas Industries.
9. ANSI/AWS B2.1, Standard Specification for Welding Procedure and Performance Qualification.
10. ANSI/AWS D10.12, Guide for Welding Mild Steel Pipe.
11. ANSI/AWWA C104, American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
12. ANSI/AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3in. Through 48in., for Water and Other Liquids.
13. ANSI/AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
14. ANSI/AWWA C151, American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
15. ANSI/AWWA C153, American National Standard for Ductile-Iron Compact Fittings, 3in. Through 24in., and 54in. Through 64in., for Water Service.
16. ANSI / NSF Standard 14 Plastic Piping System Components and related.
17. ANSI / NSF Standard 61 Drinking Water System Components – Health effects.
18. ANSI / UL 263 Standard for Safety for fire test of Building Construction and materials.
19. NSF/ANSI 14 – Plastic Piping System Components and related materials.
20. NSF/ANSI 14 – Plastic Piping System Components and related materials.
21. NSF 372 – Drinking Water System Components – Lead Content
22. ANSI Z21.15 - Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
23. ANSI/ASME B40.1 Pressure Gauges.
24. ANSI/ASME B40.2 Thermometers.

B. ASME (American Society of Mechanical Engineers)

1. ASME A112.1.2, Air Gaps in Plumbing Systems.
2. ASME A112.14.1, Back Water Valves.
3. ASME A112.36.2M, Clean-outs.
4. ASME B16.5, Pipe Flanges and Flanged Fittings.
5. ASME B16.20, Metallic Gaskets for Pipe Flanges- Ring-Joint, Spiral-Wound, and Jacketed.
6. ASME B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
7. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
8. ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings.
9. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

10. ASME B18.2.1, Square and Hex Bolts and Screw- Inch Series.
11. ASME B18.10, Track Bolts and Nuts.
12. ASME B31.1, Power Piping.
13. ASME B31.9, Building Services Piping.
14. ASME B40.1, Gauges- Pressure Indicating Dial Type- Elastic Element.
15. ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).
16. ANSI/ASME B16.3, Malleable Iron Threaded Fittings.
17. ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.
18. ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
19. ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
20. ASME B16.25, Butt-Welding Ends.
21. ANSI/ASME B16.29, Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings (DWV).
22. ANSI/AWA C606, Grooved and Soldered Joints.

C. ASSE (American Society of Sanitary Engineers)

1. ASSE 1001, Hose Connection Vacuum Breakers.
2. ASSE 1010, Water Hammer Arresters.
3. ASSE 1013, Reduced Pressure Principle Backflow Preventor.
4. ASSE 1015, Double Check Backflow Prevention Assembly.
5. ASSE 1016, Automatic compensating Valves for Individual Showers and Tub/Shower Combinations.
6. ASSE 1017, Temperature Actuating Mixing Valves for Hot Water Distribution Systems.
7. ASSE 1019, Vacuum Breaker Wall Hydrants, Frost Resistant Automatic Draining Type.
8. ASSE 1022, Dual Check with atmospheric port.
9. ASSE 1069, Automatic Temperature Control Mixing Valves.
10. ASSE 1070, Water Temperature Limiting Devices.
11. ASSE 1071, Temperature Actuated Mixing Valves for Plumbing Emergency Equipment.

D. ASTM (American Society for Testing and Materials)

1. ASTM A36, Standard Specification for Carbon Structural Steel.
2. ASTM A47, Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
5. ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
6. ASTM A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
7. ASTM A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
8. ASTM A183, Standard Specification for Carbon Steel Track Bolts and Nuts.
9. ASTM A193, Standard Specification for Alloy Steel and Stainless Steel Bolting Materials for High-Temperature Service.
10. ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High-Temperature Service.
11. ASTM A276, Standard Specification for Stainless Steel Bars and Shapes.

12. ASTM A278, Standard Specification for Gray Iron Castings for Pressure Containing Parts.
13. ASTM A351, Standard Specification for Stainless Steel Bars and Shapes.
14. ASTM A395 - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
15. ASTM A536, Standard Specification for Ductile Iron Castings.
16. ASTM A564, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
17. ASTM A582, Standard Specification for Free-Machining Stainless Steel Bars.
18. ASTM A780, Standard Practice for Repair of Damaged and Un-coated Areas of Hot-Dip Galvanized Coatings.
19. ASTM B16, Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
20. ASTM B32, Standard Specification for Soldered Metal.
21. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.
22. ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
23. ASTM B75 - Standard Specification for Seamless Copper Tube.
24. ASTM B88, Standard Specification for Seamless Copper Water Tubes.
25. ASTM B124, Standard Specification for Copper and Copper Alloy Forging Rod, Bar and Shapes.
26. ASTM B148, Standard Specification for Aluminum-Bronze Sand Castings.
27. ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
28. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
29. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
30. ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
31. ASTM B819, Standard Specification for Seamless Copper Tube for Medical Gas Systems.
32. ASTM B584, "Standard Specification for Copper Alloy Sand Castings for General Applications.
33. ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
34. ASTM C33, Standard Specification for Concrete Aggregates.
35. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
36. ASTM C150, Standard Specification for Portland Cement.
37. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
38. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
39. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications.
40. ASTM C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrinking).
41. ASTM C1540, Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
42. ASTM D2321, Standard Practice for Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
43. ASTM D635, Standard Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position.
44. ASTM D1784 – Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

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45. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
46. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
47. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.
48. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
49. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
50. ASTM D2464, Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings.
51. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
52. ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
53. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
54. ASTM D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
55. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
56. ASTM D2661, Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste and Vent Pipe and Fittings.
57. ASTM D2665, Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
58. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
59. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
60. ASTM D2729, Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
61. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
62. ASTM D2765, Test methods for determination of Gel Content and Swell Ratio of Cross-Linked Ethylene Plastics.
63. ASTM D2846, Standard Specification for Chlorinated Polyvinyl Chloride (CPVC) Plastic Hot- and Cold-Water Distribution Systems.
64. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
65. ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.
66. ASTM D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
67. ASTM D3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
68. ASTM D3138, Standard Specification for Solvent Cements for Transition Joints between Acrylonitrile-Butadiene-Styrene (ABS) and Poly Vinyl Chloride (PVC) Non-Pressure Piping Components.
69. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
70. ASTM D6394, Specification for Sulfone Plastics (SP).

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

71. ASTM E1, Standard Specification for ASTM Thermometers.
72. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
73. ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
74. ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
75. ASTM F402, Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners used for Joining Thermoplastic Pipes and Fittings.
76. ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
77. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
78. ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
79. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
80. ASTM F493, Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
81. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.
82. ASTM F645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water- Pressure Piping Systems.
83. ASTM F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
84. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
85. ASTM F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
86. ASTM F876, Standard Specification for Cross-Linked Polyethylene (PEX) Tubing.
87. ASTM F877, Standard Specification for Cross-Linked Polyethylene (PEX) Plastic Hot-and-Cold-Water Distribution Systems.
88. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.
89. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.
90. ASTM F1476 – “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.”
91. ASTM F1960. Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-Linked Polyethylene (PEX) Tubing.
92. ASTM F2389-07 – Standard Specification for Pressure-Rated Polypropylene (PP) Piping Systems.

E. AWS (American Welding Society)

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
2. ANSI/AWS B2.1, Standard Specification for Welding Procedure and Performance Qualification.
3. AWS D1.1, Structural Welding Code- Steel.
4. ANSI/AWS D10.12, Guide for Welding Mild Steel Pipe.

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

F. AWWA (American Water Works Association)

1. AWWA C600, "Standards for Insulation of Ductile-Iron Water Mains and their Appurtenances.
2. AWWA C700, "Standard for Cold-Water Meters- Displacement Type, Bronze Main Case.
3. AWWA C702, "Cold-Water Meters- Compound Type.
4. ANSI/AWWA C104, "American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
5. AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
6. ANSI/AWWA C110, "American National Standard for Ductile-Iron and Gray-Iron Fittings, 3in. Through 48in., for Water and Other Liquids.
7. ANSI/AWWA C111, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
8. ANSI/AWWA C151, "American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
9. ANSI/AWWA C153, "American National Standard for Ductile-Iron Compact Fittings, 3in. Through 24in., and 54in. Through 64in, for Water Service.
10. ANSI/AWWA C606, "Grooved and Shouldered Joints.
11. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.
12. AWWA C904, "Standard for Cross-Linked Polyethylene (PEX) pressure pipe, ½ inch through 3 inch for water service
13. AWWA C950 - Fiberglass Pressure Pipe.

G. IEEE (Institute of Electrical and Electronics Engineers)

H. IMC (International Mechanical Code)

I. IPC (International Plumbing Code)

J. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 67 - Butterfly Valves.
3. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
4. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
5. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
6. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

K. MOSHA (Maryland Occupational Safety and Health Administration)

L. NEC (National Electrical Code)

M. NEMA (National Electrical Manufacturers Association)

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

- N. NFPA (National Fire Protection Association)
 - 1. NFPA 54, National Fuel Gas Code.
 - 2. NFPA 70, National Electrical Code.
 - 3. NFPA 99 - Standard for Health Care Facilities.
- O. OSHA (Occupational Safety and Health Administration)
- P. UL (Underwriters' Laboratories)
 - 1. UL 273 – Standard for Test for Surface Burning Characteristics of Building Materials

1.5 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.
- C. Maintenance data to be included in the operation and maintenance manual specified in Division 01. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing. Include data for the following:
 - 1. Pipe Materials
 - 2. Flow Measuring Systems
 - 3. Plumbing Specialties
- D. Project Record Documents: Record actual locations of piping mains with invert elevations, valves, manholes, and leak detection and location system.
- E. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- F. Polypropylene (PP-R) welding certificates signed by the manufacturer certifying that installers comply with all the requirements specified by the piping manufacturer and have been thoroughly trained in the installation and welding of Polypropylene (PP-R) piping.
- G. Certification of compliance with ASTM, ASME and ANSI manufacturing requirements for pipe, fittings, and specialties.

- H. Submit flange gasket bolt tightening sequence and torque requirements for review as part of gasket submittals.
- I. Product Data: Submit data on each type of pipe material and fittings. Submit manufacturer's catalogue information.
- J. Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable grooved system manufacturer's style or series number.
- K. Welders' Certificate: Include welders' certification of compliance with AWS D1.1.
- L. Fuel Piping Specialties: Submit manufacturer's catalog information including capacity, rough-in requirements, and service sizes.
- M. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- B. Furnish shutoff valves complying with ASME B16.33 or ANSI Z21.15
- C. Perform work in accordance with Authority Having Jurisdiction requirements
- D. ASME (American Society of Mechanical Engineers) Compliance; comply with:
 - 1. ASME B31.9, Building Services Piping, latest edition.
 - 2. ASME B31.1, Power Piping, latest edition.
- E. Gas Installer Qualifications: Installation and replacement of gas piping, gas utilization equipment or accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified is defined as experienced in such work (experienced shall mean having a minimum of 5 previous projects similar in size and scope to this project), familiar with precautions required, and has complied with the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the Architect.

- F. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for coupling housings, fittings, valve bodies, etc...shall be date stamped for quality assurance and traceability.
- G. Regulatory Requirements: Comply with the requirements of the following additional codes:
 - 1. NFPA 54, National Fuel Gas Code for gas piping materials and components, gas piping installations, and inspection, testing, and purging of gas piping systems.
 - 2. International Mechanical Code (IMC).
 - 3. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
 - 4. PHCC - National Standard Plumbing Code, latest edition.
 - 5. NFPA 31, Standard for the Installation of Oil Burning Equipment for oil piping materials and components, oil piping installation, and inspection, and testing of fuel oil piping systems.
 - 6. HB 372 Business Occupations and Professions – Plumbers – Lead Free Materials.
- H. Cast Iron Pipe; No Hub: All pipe and fittings shall bear the Collective Trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Requirements for transporting, handling, storing, and protecting products.

- B. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
- D. Polypropylene piping shall be protected from harmful UV radiation. Piping shall be kept on site in its protective cover until ready to be installed. Cover un-bagged pipe with a light-colored tarp until ready to be installed. Where indicated on the drawings that the pipe will be exposed to direct UV light for more than 30 days, it shall be provided with a Factory applied, UV-resistant coating or alternative UV protection.
- E. Handling Flammable Liquids: Remove and legally dispose of liquid from drips in existing gas piping and handle cautiously to avoid spillage or ignition. Notify the gas supplier. Handle flammable liquids used by the installer with proper precautions, and do not leave on the premises from the end of one working day to the beginning of the next.
- F. Do not expose PEX piping to direct sunlight for more than 30 days.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section: "Product Requirements": Environmental conditions affecting products on site.
- B. Do not install underground piping when bedding is wet or frozen.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.13 COORDINATION

- A. Division 01 Section: "Administrative Requirements": Requirements for coordination
- B. Notification of Interruption of Service: Provide notification for all utility outages.
- C. Work Interruptions: When interruptions in work occur while repairs or alterations are being made to an existing piping system, leave the system in safe condition.
- D. Coordinate installation of buried piping with trenching.
- E. Coordinate the installation of pipe sleeves for foundation wall penetrations.
- F. Coordinate the size and location of concrete pads. Cast anchor bolt inserts into pad.
- G. Coordinate the installation of roof piping support, and roof penetrations.

PART 2 - PRODUCTS

2.1 PIPE AND TUBE MATERIALS AND APPLICATION SCHEDULE

Domestic Cold, Hot, and Circulating Hot Water (Potable and Non- Potable)	Pipe Material	Fitting Material	Joint Material

(Above Grade)	Copper Tube: ASTM B88, Type L, Seamless, Water tube, hard-drawn temper	ASME B16.51, ICC LC 1002, IAPMO PS 117, NSF61, NSF61-G or NSF372.	ProPress fittings ½-inch thru 4-inch shall be joined using appropriate sized Ridgid ProPress Tools. ProPress fittings shall be installed according to the most current edition of the Viega installation guidelines. Installers shall attend a Viega ProPress installation training class
	For pipe sizes 3" or less; PEX-a ASTM F876/877, Engle-method PEX	For sizes 3" or less; ASTM F1960 cold expansion fitting, ASTM D6394 polysulfone or lead-free (LF) brass, with PEX-a reinforcing cold-expansion ring.	Install fittings and joints using cold expansion method with PEX-a reinforcement rings.

Sanitary, Sanitary Vent, and Storm Water	Pipe Material	Fitting Material	Joint Material
	Poly Vinyl Chloride (PVC); DWV pipe, ASTM D2665, Schedule 40, solid wall plain ends. PVC material shall comply with the material requirements of ASTM D1784 and have a cell classification of 12454.	PVC, ASTM D2665, PVC material shall comply with the material requirements of ASTM D1784 and have a cell classification of 12454	ASTM D2855, solvent weld with ASTM D2564 solvent cement.

Air Conditioning Condensate, Equipment Drains, and Overflows	Pipe Material	Fitting Material	Joint Material
	PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.	ASTM D2466, Schedule 40, PVC	ASTM D2855, solvent weld with ASTM D2564 solvent cement.

A. Alternate Piping System – Press Fitting Systems – Domestic Cold, Hot and Hot Water Recirculating Systems

1. Manufacturers:

a. Copper Press Fitting:

- 1) Viega, Nibco, Apollo XPress, Grinnell or comparable acceptable product.

2. Material:

a. Press Fitting:

- 1) Bronze or copper, shall conform to the material requirements of ASME B16.18 or ASME B16.22, ASME B16.51 and the performance requirements of IAPMO PS117, ICC LC1002. ½-inch thru 4-inch for use with ASTM B88 copper tube type K, L, or M and ½-inch up to include 1-1/4-inch annealed copper tube. Press-seal fittings shall have an EPDM sealing element and an un-pressed fitting leak identification feature. 2-1/2-inch thru 4-inch shall have a 420 stainless steel grip ring, PBT separator ring, EPDM sealing element and an un-pressed fitting leak identification feature. Sealing elements shall be verified for the intended use.
- 2) Note: Press-Seal fittings with EPDM sealing element shall conform to NSF 61, NSF 61-G when installed in a potable water system.

2.2 UNDERGROUND PIPE MARKERS

- A. Furnish materials in accordance with the requirements of the authority having jurisdiction.
- B. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.
- C. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Domestic Water Service", "Fuel Oil Piping", "Natural Gas Service", "LPG Service" or "Sewer Service" in large letters.

2.3 PIPING SPECIALTIES

- A. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents:
1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8" maximum thickness, except where thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125 cast-iron and cast bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.
 2. ASME B16.20, for grooved, ring joint, steel flanges.
 3. AWWA C110, rubber, flat face, 1/8 inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.
- B. Flange Bolts and Nuts:
1. ASME B18.2.1, carbon steel, except where other material is indicated.
- C. Plastic Pipe Flange Bolts, Washers and Nuts: Type and material recommended by piping system manufacturer, except where other type or material is indicated. Flat washers must be used under nuts and bolts. Gaskets to be full face, 1/8th inch thick, 70 durometer and of a material recommended for the application by the manufacturer.
- D. Unions: Lead Free, ANSI B16.39, Class 150, malleable iron; female pattern; brass to iron seat; ground joint. Threads shall conform to ANSI/ASME B1.20.1. Unions in copper piping shall be sweat fittings with bronze seats designed for 200 psig working pressure.
- E. Dielectric Unions: Lead Free, provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.
- F. Dielectric Fittings: Lead Free, provide dielectric fittings with appropriate end connections and piping materials. Dielectric fittings shall be as manufactured by Victaulic Style 47, Legend Valve Company Model T-575 or acceptable comparable product.
- G. Dielectric Waterway: Copper silicon casting conforming to UNS C87850 with grooved and/or threaded ends. UL classified in accordance with NSF-61 for potable water service and shall meet the low-lad requirements of NSF-372. Basis of Design: Victaulic Series 647.
- H. Flexible Gas Piping Specialties:
1. Basis of design shall be WARDFlex MAX as manufactured by Wardflex Manufacturing, LLC, comparable products as manufactured by Gastite or Proflex may be submitted as a compatible product.

2. Piping must be arc-resistant
3. Striker Plates:
 - a. Striker plates shall be listed as part of the flexible gas piping system and shall be marked with the symbol of the Manufacturer and the listing Agency (CSA International).
 - b. Striker plates shall be made from carbon steel, heat-treated to RB40.
 - c. Striker plates shall be available in Quarter, Half, Three Quarter, Full and 3.5 x 17.5 configurations.
4. Floppy Conduit:
 - a. Floppy conduit used for additional protection with striker plates shall be made from galvanized steel.
5. Accessories:
 - a. Termination fittings shall be used to provide a secure termination for tubing at moveable appliance locations and other "stub-out" points depending on building construction. Termination fittings shall consist of a plated carbon steel plate or malleable iron mounting flange and a Wardflex mechanical joint. Fittings at termination mounts shall be accessible and provide a fitting joint exterior to the building floor or wall.
 - b. Meter stub-outs or outdoor termination fittings shall be used for exterior wall penetrations at meter locations and other penetrations such as roof top units. Meter stub-outs shall consist of a schedule 40 carbon steel pipe with a mounting plate. Outdoor termination fittings shall consist of a plated carbon steel plate or malleable iron mounting flange, a WARDFex mechanical joint and two o-rings. Fittings at meter termination outlets shall be accessible and provide a fitting joint exterior to the building.
 - c. Manifolds shall be made from malleable iron with black e-coating. Manifolds may be mounted using available manifold brackets or Gas Load Centers; they may alternatively be mounted using conventional pipe mounting methods.

I. PEX-a Piping System Specialties

1. Multi-port Tees: provide Uponor or approved equal ASTM D 6394 multiport tees with ASTM F1960 outlets.
2. Threaded Brass to PEX-a Transition fitting: one-piece lead-free (LF) brass fitting with male or female threaded adapter and ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
3. Brass Sweat to PEX-a Transition: one-piece lead-free (LF) brass fitting with sweat adapter and F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

J. PEX-Copper Transition Fittings/Elbows/Support Manifold Brackets

1. PEX-to Metal Transition Fittings:
 - a. Manufacturers: Provide fittings from the same manufacturer of the piping.
 - b. PEX-a to Thread Transition: One-piece brass fitting with male or female threaded adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold expansion ring.

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- c. PEX-a to Copper Press Transition: One piece lead free (LF) brass fitting with one ASME B16.51 copper press end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- d. PEX-a to Groove Transition: One-piece lead free (LF) brass fitting with one CSA B242-05 groove end in either iron pipe size (IPS) or copper tube size (CTS) and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- e. PEX-a to Water Meter Transition: Two-piece fitting with one NPSM union thread and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- 2. Plumbing Fixture Copper Stub Rough-in Elbow:
 - a. Provide Copper stubs sizes as required to suit pipe sizes indicated on contract drawings.
 - b. Type L copper comprised of either 1/2", 3/4" or 1" as required.
 - c. Basis of Design: Uponor PROPEX Lead Free Copper Stub Ells.
- 3. PEX Wall Support Bracket Manifolds: Multiple-outlet assembly complying with ASTM F 877 (CAN/CSA B137); with ASTM F 1960 outlets.
 - a. Engineered polymer valveless manifold, Uponor model A5750500 or comparable acceptable product.
- 4. PEX-to-thermoplastic Transition Fittings:
 - a. PEX-a to CPVC Transition: thermoplastic fitting with one spigot or socket end and one ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.

K. PEX VALVES

- 1. PEX-to-PEX, Lead Free (LF) Brass Ball Valves (1/2 inch through 2 inch nominal pipe size)
 - a. Manufacturers: Provide ball valve(s) from the same manufacturer as the piping system.
 - b. Full-port ball valve: two-piece, ASTM F1960 cold expansion ends, with PEX-a reinforcing cold-expansion ring.
 - c. LF brass valve with a positive stop shoulder manufactured from C69300 brass.
 - d. In compliance with: 250 CWP, ANSI/NSF 359, ANSI/NSF 14/61, cNSF-us-pw_G lead free 0.25% Lead max., ASTM F 1960, ASTM F 877 (CAN/CSA B137.5).

L. Strainers – "Y" Type:

- 1. Strainers shall be lead free and of the basket or "Y" design, as manufactured by Watts, Nibco, Victaulic, Wilkens (A Zurn company), Grinnell, Conbraco Industries; Apollo or an comparable acceptable product. Bodies shall have arrows clearly cast on the sides to show flow direction. Strainers shall be equipped with easily removable covers and standard stainless steel screens. Total area of perforations shall be not less than four times the cross section of the entering pipe.
- 2. Provide valved blow off connections for all strainers full size of blow off tapping, with capped ends.

M. Expansion Tanks:

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1. Provide diaphragm type expansion tank as manufactured by Zurn Model WTTA, Amtrol – Therm-X-trol, Taco Model No. PAX, or Bell and Gosset Model PTA.
2. Size and number as indicated; construct of welded carbon steel for 125 psig working pressure, 375°F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity, by means of a flexible diaphragm securely sealed into tank. Provide taps for air charging fitting, and drain plug. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Tank, with taps and supports, shall be constructed, tested, and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Division 1. Tanks shall be provided with integral base ring for vertical mounting.

N. Basket Strainers:

1. Strainers shall be lead free as manufactured by, Watts, Nibco, Metraflex, or Spirax Sarco.
2. 125 psig working pressure; high tensile cast-iron body (ASTM A126, Class B), flanged end connections, bolted cover, perforated Type 304 stainless steel basket, and bottom drain connection.

O. “Y” type Strainer

1. Strainers shall be lead free as manufactured by Zurn/Wilkins, Mueller, Nibco Metraflex, Watts, Spirax Sarco, or Apollo.
2. 125 psig working pressure: Ductile Iron ASTM A536 main valve body, NSF approved epoxy finish, flanged end connections, bolted access cover, perforated Type 300 Series stainless steel screen, and bottom drain connection

P. Vacuum Breakers:

1. Pipe Applied, Atmospheric Vacuum Breaker shall conform to ASSE 1001, with floating disc and atmospheric vent.
2. Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.
3. Laboratory Faucet Vacuum Breakers: ASSE 1035, chrome plated; consisting of primary and secondary checks, intermediate vacuum breaker, threaded ends, 1/4” or 3/8” size as required, for continuous pressure application.
4. Vacuum breakers shall be lead free.

Q. Water Hammer Arresters:

1. Water hammer arresters shall be Zurn Model WH-2950-XL. Comparable products as manufactured by Jay R. Smith, Josam, Precision Plumbing Products, or Watts, may be submitted for review.
2. ASSE 1010, or PDI WH-201, “Water Hammer Arresters,” “latest edition”, bellows or piston type with pressurized cushioning chamber. Sizes are based on water-supply fixture units, sizes “A” through “F” and PDI WH-201, sizes “A” through “F.”
3. Water Hammer Arresters shall be lead free when used with lead-free end user devices and piping that are required by Maryland law to be lead free.

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- R. Welding Materials: Comply, with Section II, Part C. ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

S. Drainage System Specialties

1. Horizontal Backwater Valves: ASME A112.14.1, cast iron body, with removable bronze swing check valve, threaded or bolted cover, as manufactured by Jay R. Smith, Josam, Watts, or Zurn.
 - a. Extension: Full size, service class, cast iron soil pipe extension to field installed cleanout at floor. Extensions shall be Zurn Model Z1095-FC. Comparable products as manufactured by Josam or J.R. Smith may be submitted for review.
2. Vent Caps shall be Zurn Model Z193 cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and set-screws to secure to vent pipe. Comparable products as manufactured by Josam or J.R. Smith may be submitted for review.
3. Cleanouts: ASME A112.36.2M, cast-iron body with straight threads and gasket seal or taper threads for plug flashing flange and clamping ring, and a brass closure plug. Cleanouts for installation in floors not having membrane waterproofing may be furnished without clamping ring.

Cleanouts in Concrete Floors	Zurn Model No. Z-1400-BZ1-BP, or Watts Model C0-200-RX cast iron body, bronze plug to suit floor finish with adjustable round scoriated top. Comparable products as manufactured by J.R. Smith or Josam may be submitted for review.

Cleanouts in Finished Floors	Zurn Model No. ZN-1400-BZ1-BP cast iron body, bronze plug and scoriated adjustable nickel bronze leveling cover. ZN-1400-X-BP cast iron body, bronze plug and recessed nickel bronze top to suit floor finish for vinyl tile or ZN-1400-CM-BP cast iron body, bronze plug with nickel bronze top and carpet marker to suit floor finish for carpet. Comparable products as manufactured by Jay R. Smith, Josam, or Watts may be submitted for review.

Cleanouts in Piping	Zurn Model No. Z-1440-BP, or Watts Model C0-380 epoxy coated cast iron body with bronze plug, comparable products as manufactured by Josam or J.R. Smith may be submitted for review.

Cleanouts in Walls	Zurn Model No. Z-1441-BP-VP, or Watts Model C0-380-RD style to suit wall finish, with epoxy coated cast iron body, bronze plug and vandalproof screws. Comparable products as manufactured by J.R. Smith or Josam may be submitted for review.

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4. Floor Drains/Sinks: Floor drains/sinks shall be as manufactured by Zurn, or Watts. Comparable products as manufactured by Jay R. Smith, Josam, Orion, or Wade may be submitted for review.
 - a. Floor Drains (Sanitary Waste):
 - 1) Zurn Model ZN-415-BZ6-TC-P, or Watts Model FD-103-A6, Dura coated cast iron body and clamp collar with 6" diameter nickel bronze leveling strainer with removable debri cover and trap primer connection.
 - b. Floor Sinks:
 - 1) Zurn Model Z-1900-32-W/Z1023 or Watts Model FS-730-7, cast iron body, slotted grate, porcelain enamel coated interior and top, aluminum interior dome strainer, 1/2" trap primer connection.
5. Deep Seal Traps: Zurn Model Z-1000-P Cast iron or bronze, with inlet and outlet matching connected piping, cleanout where indicated, and trap seal primer valve connection. Comparable products as manufactured by Charlotte Pipe, Jay R. Smith, or Josam may be submitted for review.
 - a. 2-Inch Size: 4-inch-minimum water seal.
 - b. 2 1/2 Inches and Larger: 5-inch-minimum water seal.
6. Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.
7. Air Gap Fittings: ASME A112.1.2, cast iron or cast bronze, with fixed air gap, inlet for drain pipe or tube, and threaded or spigot outlet.
8. Parapet Scupper: Watts Model RD-270, or Zurn Z-198. Comparable products as manufactured by Jay R. Smith, or Josam, may be submitted for review.
9. POINT OF USE SOLIDS INTERCEPTOR
 - a. Basis of design shall be STRIEM model sidekick. Comparable products as manufactured by Zurn shall be submitted for approval as a comparable product.
 - b. Striem solids interceptor model SIDEKICK shall be lifetime guaranteed and made in the USA.
 - c. Interceptor shall be constructed of an injection molded PVC housing and polycarbonate perforated basket.
 - d. Interceptor is manufactured for above-grade installation.
 - e. Basket shall provide the ability for side-access maintenance and shall be clear to allow visibility into unit.
 - f. Solids capacity shall be 0.17 gallons.
 - g. Interceptor shall be certified to IAPMO IGC 167-2011ae2 and carry a UPC listing
- T. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type where required to conceal protruding fittings and sleeves.
 1. Inside Diameter: Closely fit around pipe, tube, and insulation.
 2. Outside Diameter: Completely cover opening.
 3. Cast Brass: One-piece, with set-screw.
 4. Cast Brass: Split casting, with concealed hinge and set-screw.
 - a. Finish: Rough brass.
 - b. Finish: Polished chrome plate.

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5. Stamped Steel: One-piece, with set-screw and chrome-plated finish.
 6. Stamped Steel: Split plate, with concealed hinge, set-screw, and chrome-plated finish.
 7. Cast-Iron Floor Plate: One-piece casting.
- U. Dielectric Fittings: Lead free assembly or fitting having insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion.
1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
 2. Insulating Material: Suitable for system fluid, pressure, and temperature.
 3. Dielectric Unions: Factory-fabricated, union assembly for 250-psig minimum working pressure at a 180°F temperature.
 4. Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150-or 300-psi minimum pressure to suit system pressures.
 5. Dielectric-Flange Insulation Kits: Materials for flange isolation kits on pipes containing drinking/potable water (up to 280°F) shall consist of the following components:
 - a. Isolating and Sealing Gasket:
 - 1) The full faced, NSF 61 certified, isolating and sealing gasket shall be LineBacker® 61™ Sealing Gasket (LB61) – Type “E”, 1/8” thick, G-10 retainer containing a precision tapered groove to accommodate the controlled compression of a EPDM quad-ring sealing element. Sealing element placement shall accommodate either flat, raised face or RTJ flanges.
 - 2) The quad-ring seal shall be pressure energized. The G-10 retainer shall have a 550 volts/mil dielectric strength and a minimum 50,000 psi compressive strength.
 - 3) The full faced flange isolating gasket (weld-neck) shall be equal to or slightly smaller than the bore of the flange; (slip-on) shall be equal to or smaller than the I.D. of mating pipe.
 - b. Full Length Bolt Isolating Sleeves:
 - 1) One full length G-10 Sleeve (extending half way into both steel washers) for each flange bolt. The G-10 shall be a 1/32 inch thick tube with a 400 volts/mil dielectric strength and water absorption of 0.10% or less.
 - c. Washers:
 - 1) Two, 1/8 inch thick, G-10 isolating washers for each bolt. Their compressive strength shall be 50,000 psi, dielectric strength 550 volts/mil and water absorption 0.10% or less.
 - 2) Two, 1/8 inch thick zinc plated, hot rolled steel washers for each bolt. The I.D. of all washers shall fit over the isolating sleeve and both the steel and isolating washers shall have a same I.D. and O.D.
 - d. Quality:
 - 1) Flange isolating kits shall be manufactured at a facility that has a registered ISO 9001:2008 Quality Management System. Submittals shall include copy of valid ISO registration and NSF 61 certification.
 - e. Basis of Design:
 - 1) Flange gasket kits shall be manufactured by PSI-Pipeline Seal and Insulator, Inc., Houston, Texas. Comparable products shall be submitted as required

under Section Product Requirements for comparable product review.
Products should be submitted to engineer 10 days prior to bid due date.

6. Dielectric Couplings: Lead free galvanized-steel coupling, having inert and noncorrosive, thermoplastic lining, with threaded ends and 300-psig minimum working pressure at 225° temperature.
7. Dielectric Nipples: Lead free electroplated steel or ductile nipple, having inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig working pressure at 230 °F temperature. Victaulic Style 47 or Grinnell Style 407.
8. Dielectric Waterway: Copper silicon casting conforming to UNS C87850 with grooved and/or threaded ends. UL classified in accordance with NSF-61 for potable water service, and shall meet the low-lead requirements of NSF-372. Basis of Design: Victaulic Series 647.

V. Thermometers, General

1. Scale Range: Temperature ranges indicated in degrees Fahrenheit shall be provided for services listed as follows:
 - a. Domestic Hot Water: 30 to 180°F, with 2-degree scale divisions.
 - b. Domestic Cold Water: 0 to 100°F, with 2-degree scale divisions.
2. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
3. Liquid-in-glass Thermometers
 - 1) Provide as manufactured by H.O. Trerice, Weiss Instruments, Weksler Instrument Corp., or Miljoco.
 - 2) Description: ASTM E1, liquid-in-glass thermometer. Delete ASTM E1 as this specification is strictly set aside for engraved glass tube laboratory thermometers. Insert ANSI/B40.2 in its place.
 - 3) Case: High Pressure Die-cast aluminum-finished in baked-epoxy enamel, glass front, spring secured, 9 inches long.
 - 4) Adjustable Joint: Finished to match case, 180° (3.1rad) adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.
 - 5) Tube: Blue-reading, organic liquid-filled instead of mercury-filled, with magnifying lens.
 - 6) Scale: White coated aluminum with permanently baked bold black markings.
 - 7) Stem: Copper-plated steel, Zamac Alloy, aluminum, or brass for a separable socket of length to suit installation.
 - 8) Thermowell: Brass NSF/ANSI 372 separable socket of suitable length for installation.

W. Pressure Gages, General

1. Provide as manufactured by H.O. Trerice Co., Weiss Instruments, Inc., Weksler Instrument Corp., or Miljoco.
 - a. Description: ASME B40.1, Grade A phosphor-bronze Bourdon-tube pressure gage, with bottom connection.

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- b. Case: Drawn steel, brass, or aluminum with 4 1/2 -inch -diameter glass lens.
- c. Connector: Brass, 1/4" inch NPS.
- d. Scale: White-coated aluminum, with permanently etched markings.
- e. Accuracy: Plus or minus 1 percent of range span.
- f. Range: **<<Edit to suit project specifics>>**
 - 1) Hydronic System: 0 – 100 psi.
 - 2) High Pressure Steam System: 0 – 200 psi.
 - 3) Medium Pressure Steam System: 0 – 100 psi.
 - 4) Low Pressure Steam System: 0 – 50 psi.
- g. Snubbers: 1/4" inch brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.
- h. Needle Valve: Exceed pressure and temperature rating of installation.

X. Test Plugs:

- 1. Provide as manufactured by Flow Design, Inc., Peterson Equipment Co., H.O. Trerice, or Miljoco, Weiss.
- 2. Description: Nickel-plated brass-body test plug in 1/2" inch fitting.
- 3. Body: Length as required to extend beyond insulation.
- 4. Pressure Rating: 500 psig minimum.
- 5. Core Inserts: 2 self-sealing valve types, suitable for inserting a 1/8" inch (3mm) outside-diameter probe from a dial thermometer or pressure gage.
- 6. Core Material: According to the following for fluid and temperature range:
 - a. Air, Water, Oil, and Gas: 20°F to 200°F, neoprene rubber.
 - b. Air and Water: Minus 30°F to 275°F, ethylene-propylene-diene-terpolymer (EPDM) rubber.
- 7. Test-Plug Cap: Gasketed and threaded cap, with retention chain.
- 8. Test Kit: Provide test kit consisting of 1 pressure gage and gage adapter with probe, 2 bimetal dial thermometers and a carrying case.
- 9. Pressure Gage and Thermometer Ranges: Approximately 2 times systems operating conditions.

Y. Domestic Water Mixing Valves

- 1. Thermostatic Mixing Valves:
 - a. Provide Thermostatic Mixing Valves as manufactured by Acorn Controls, Lawler, Leonard or Powers.
 - b. The thermostatic mixing valve shall be IAPMO lab certified to ASSE 1017 and CSA standards and capable of meeting the control accuracy requirements of these standards at the manufacturers listed minimum flow rates.
 - c. The valve shall contain an advanced paraffin sensor with a temperature range of 100F to 160F and factory set at 120F with a lock nut to prevent unauthorized temperature changes.
 - d. Checks and screens are required at both inlets.
 - e. Maximum inlet pressure is 125 PSI
 - f. Maximum inlet temperature is 180F
 - g. Inlet/Outlet temperature differential minimum (approach) is 5F

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- h. Provide external ball valves at all inlets and outlets
 - i. Body material to be Lead-Free brass with corrosion resistant internal components.
- 2. ASSE 1070 Public Hand Washing Mixing Valve:
Provide Acorn Controls model ST70, Watts Series LFUSG – B, Thermostatic Mixing Valve, Leonard Models 170-LF-BP or 170A-LF-BP, Conbraco Industries; Apollo Model 34DLF, or Thermostatic Mixing Valve. Comparable products as manufactured by Bradley or Zurn may be submitted for review as a comparable product.
 - a. ASSE 1070 and IAPMO cUPC listed to control the temperature of hot water.
 - b. Lead Free Brass 4 – Port 'H' pattern body or factory supplied tee connection.
 - c. Include Integral Check Valves, Integral Screens and adjustment nut with locking feature.
 - d. Ranges
 - 1) Minimum supply pressure: 30 Psi
 - 2) Hot Inlet Temperature: 120° - 180°F
 - 3) Cold Inlet Temperature: 39° - 80°F
 - 4) Minimum Inlet Temperature Difference: 5°F
 - 5) Supply Temperature range: 85° - 115°F
 - 6) Maximum Pressure: 125 Psi
 - 7) Minimum Flow: 0.25 GPM
 - 8) Maximum Flow: 4.00 GPM

2.4 SLEEVE PENETRATION SYSTEMS

- A. General: Provide protective sheathing or wrapping between metal pipes and sleeves to prevent pipes from corroding.
- B. Sleeves shall be provided around all pipes through walls, floors, ceilings, partitions, structure members or other building parts. Sleeves through walls and floors shall be standard weight galvanized iron pipe two sizes larger than the pipe or insulation so that pipe or insulation shall pass through freely with space for movement for all piping which passes through masonry or concrete walls or floors. Provide 20 gauge galvanized steel sheet or galvanized pipe sleeves for all piping passing through frame walls.
- C. Sleeves through floors shall be flush with the floor except for sleeves passing through Mechanical Rooms which shall extend $\frac{3}{4}$ " above the floor. Space between the pipe and sleeve shall be caulked. Escutcheon plates shall be constructed to conceal the ends of sleeves.
- D. Sleeves through walls and floors shall be sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements": Verification of existing conditions before starting work.
- B. Verify excavations and trenches are ready to receive piping.
- C. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of installed devices. Do not proceed with installation until unsatisfactory conditions have been corrected.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- E. Examine grooved ends for form and cleanliness. Ends shall be clean and free from indentations, projections, and roll marks in the area from valve, fitting, or pipe end to (and including) the groove.
- F. Examine substrates and conditions under which pipe expansion joints, pipe alignment guides, and pipe anchors are to be installed. Do not proceed until unsatisfactory conditions have been corrected.
- G. Do not enclose, cover, or put into operation any piping system until it has been inspected by the authority having jurisdiction and tested as specified herein.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Unions and flanges for servicing and disconnect are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as disconnect points if required.)

- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. Preparation For Testing: Prepare water piping and condensate piping in accordance with ASME B31.9, and as follows:
 - 1. Test for leaks and defects in new piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.
 - 2. Leave joints including welds un-insulated and exposed for examination during the test.
 - 3. Provide temporary restraints for expansion joints, which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
 - 4. Flush system with clean water. Clean strainers.
 - a. Provide temporary circulator for steam systems.
 - b. Open a drain at the low point of the system while replacing the water through the make-up at the same rate.
 - c. Continue flushing until clean water shows at the drain, but for not less than 24 hours.
 - d. After flushing, remove strainers and clean and replace them.
 - e. System shall be drained and flushed before final filling.
 - f. Flushing pumps are to have fine mesh construction strainers installed and shall be pulled and cleaned after flush.
 - g. Coordinate with Division 23 Section: "HVAC Piping Systems Cleaning and Treatment".
 - 5. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
 - 6. Install relief valve set at a pressure no more than one-third higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.
 - 7. For Polypropylene (PP-R) piping: While still accessible all piping shall be pressure/leak tested to the manufacturer's standards. Tests shall be carried out using water, compressed air or a mixture of the two. The test pressure shall be 1.5 times the operating pressure or 150 psi, whichever is greater. Any leaks detected shall be repaired at the contractor's expense by removing the leaking part and replacing with new parts welded per the pipe manufacturer's guidelines. Tests shall be carried out following pipe manufacturer's instructions.

3.3 EXCAVATION

- A. Excavation for Utility Trenches
 - 1. Excavate trenches to indicated gradients, lines, cross sections, elevations and subgrades.
 - 2. Excavate trenches to uniform widths to provide the following clearance on each side of pipe.
 - a. Clearance: 8 inches minimum each side of pipe.

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3. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, etc. Remove projecting stones and sharp objects along trench subgrade.
 - a. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, hand-excavate trench bottoms and support pipe on an undisturbed subgrade.
 - b. For pipes 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tampered sand backfill.
 - c. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

B. Unauthorized Excavation

1. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation.

C. Backfill

1. Place and compact backfill in excavations promptly, but not before completing the following:
 - a. Construction below finish grade including, where applicable, subdrainage, damp proofing, water proofing and perimeter insulation.
 - b. Surveying locations of underground utilities for Record Documents.
 - c. Testing and inspecting underground utilities.
 - d. Removing concrete formwork.
 - e. Removing trash and debris.
 - f. Removing temporary shoring and bracing, and sheeting.
 - g. Installing permanent or temporary horizontal bracing on horizontally supported walls.
 - h. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe.
 - 1) Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping to avoid damage or displacement of piping. Coordinate backfilling with utilities testing.
 - i. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
 - j. Place and compact final backfill of satisfactory soil to final subgrade elevation.
 - k. Install detectable warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavement and slabs.

D. Compaction of Soil Backfills and Fills

1. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
2. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

3. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 - a. Under structure, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 92 percent.
 - b. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
 - c. Under lawn or unpaved areas, scarify and recompact top 6 inches subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - d. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.
 - e. Against foundation walls, scarify and recompact with and operated equipment within 3 feet of wall to avoid overstressing the wall at 95 percent.

3.4 INSTALLATION OF PIPING, GENERAL

A. Piping

1. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
2. Install concentric reducers where pipe is reduced in size in the direction of flow, with bottoms of both pipes and reducer flush.
3. Connect branch piping to mains from top of main, unless specific otherwise for specific systems.
4. Install supports in accordance with Division 22 Section: "Hangers and Supports for Plumbing Piping and Equipment".
5. Make changes in directions and branch connections using fitting, pull tees shall not be permitted.
6. Install flanges, flange kits, and unions in pipes 2 inch and smaller, adjacent to each valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
7. Install dielectric unions where piping of dissimilar metals are joined.
8. Install flanges on valves, apparatus, and equipment having 2 1/2" inch and larger connections.
9. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.
10. Install flexible connectors at inlet and discharge connections to pumps and other vibration producing equipment.
11. Install strainers on the supply side of each control valve, pressure regulating valve, and elsewhere as indicated. Install 3/4" inch NPS nipple and ball valve in blow down connection of strainers. Use same size nipple and valve as blow-off connection of strainer.
12. Anchor piping to ensure proper direction of expansion and contraction. Anchors shall attach to the building structure to prevent pipe movement. Anchors shall be installed in such a manner to prevent damage to the building structure. Anchors shall be securely welded to the piping being anchored. Install expansion loops and joints as indicated on the Drawings.

13. Install pipe sleeves at all wall and floor penetrations. Provide protective sheathing or wrapping between metal pipes and sleeves to prevent pipes from corroding.
14. Seal pipe penetrations of fire separations specified in Division 07 Section: "Joint Firestopping."
15. Hanger supports, and anchors are specified in Division 22 Section: "Hangers and Supports for Plumbing Piping and Equipment."
16. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, $\frac{3}{4}$ " ball valve, and short $\frac{3}{4}$ " threaded nipple and cap.
17. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.
18. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.
19. In concealed locations where piping, other than cast iron or galvanized steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1 $\frac{1}{2}$ " from the nearest edge of the member, the pipe shall be protected by steel shield plates. The plates shall be made of gage 16 and shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 2" above sole plates and below tip plates.
20. CPVC Piping: Ancillary products coming into contact with pipe and fittings must be chemically compatible as per FBC System Compatibility Program. For products not listed on one of these program lists, consult the product manufacturer for compatibility with CPVC.

B. INSTALLATION - ABOVE GROUND PIPING

1. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
2. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
3. Group piping whenever practical at common elevations.
4. Sleeve pipe passing through partitions, walls and floors.
5. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
6. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Provide access where valves and fittings are not accessible.
7. Install non-conducting dielectric connections wherever jointing dissimilar metals.
8. Establish invert elevations, slopes for drainage to $\frac{1}{4}$ inch per foot 2 percent minimum. Maintain gradients.
9. Slope piping and arrange systems to drain at low points.
10. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
11. Install piping penetrating roofed areas to maintain integrity of roof assembly.
12. CPVC Piping: Ancillary products coming into contact with pipe and fittings must be chemically compatible as per FBC System Compatibility Program. For products not listed on one of these program lists, consult the product manufacturer for compatibility with CPVC.

C. Joint Construction

1. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ANSI/ASME B1.20.1.
 - a. Cut threads full and clean using sharp dies.
 - b. Ream threaded ends to remove burrs and restore full inside diameter.
 - c. Apply pipe joint lubricant or sealant, suitable for the service for which the pipe is intended, on the male threads at each joint.
 - d. Tighten joint to leave not more than 3 threads exposed.
 - e. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - f. Align threads at point of assembly.
 - g. Apply appropriate tape or thread compound to the external pipe threads.
 - h. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
 - i. Damaged Threads: Do not use pipe with threads which are corroded or damaged.
 - j. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
2. Brazed Joints: For copper tube and fittings, braze joints in accordance with ASME B31, "Standard Code for Pressure Piping" and AWS "Brazing Manual."
 - a. Remove stems, seats, and packing of valves and accessible internal parts of valves before brazing.
 - b. Braze joints in accordance with ASME B31.1.
 - c. Fill the tubing and fittings during brazing with nitrogen under a continuous purge to prevent formation of scale.
 - d. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
 - e. Heat joints to proper and uniform temperature.
 - f. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Provide adequate ventilation and avoid breathing fumes.
3. Solder Joints: Solder joints shall be made in accordance with ASTM B828. Cut tube ends shall be reamed to the full inside diameter of the tube end. Joint surfaces shall be cleaned. A flux conforming to ASTM B813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B32. The joining of water supply piping shall be made with lead free solder and fluxes.
4. Press-connect fittings: Sealing element shall be verified for the intended use. Tube ends shall be cut on a right angle (square) to the tube. Tube ends shall be reamed and chamfered with all grease, oil, or dirt shall be removed from the tube end with a clean rag. Visually examine the fitting sealing element to ensure there is no damage and that it is properly seated into the fitting. Insert the tube fully into the fitting and mark the tube wall at the face of the fitting. Always examine the tube to ensure it is fully inserted into the fitting prior to pressing the joint. ProPress fittings ½-inch thru 4-inch shall be joined using appropriate sized Viega approved ProPress Tools. ProPress fittings shall be installed

- according to the most current edition of the Viega installation guidelines. Contractor or installer shall be trained by the manufacturer's representative prior to commencement of product installation.
5. Mechanical Joints: Follow grooved-end mechanical coupling manufacturer's written instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved system manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.
 - a. Tongue and recess couplings (required a gap and specific torque value to obtain specified performance) will only be permitted if a torque wrench is used for installation. Required torque shall be in accordance with manufacturer's latest installation instructions and best practices recommendations.
 6. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.
 7. Grooved Joints: Assemble joints in accordance with fitting manufacturers written instructions. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved system manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.
 8. CPVC Pipe Joint Construction: Assemble joints in accordance to manufacturer's instructions. Cut pipe square, ream interior of pipe, chamfer the exterior of the pipe, wipe/clean filings and other construction debris off of pipe and fitting, solvent cement application per training and either One-Step or Two-Step as required, fully insert pipe into fitting, ¼ turn as inserting, hold for set-time, wipe off excess solvent cement. A factory-trained field representative shall provide on-site training for contractor's field personnel.
 9. Polypropylene (PP-R) fusion welding of joints:
 - a. Install fittings and joints using socket-fusion, electrofusion, or butt-fusion as applicable for the fitting or joint type. All fusion-weld joints shall be made in accordance with the pipe and fitting manufacturer's specifications and product standards.
 - b. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
 - c. Prior to joining, the pipe and fittings shall be prepared in accordance with ASTM F2389 and the manufacturer's specifications.
 - d. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.

10. PEX-a Joints, All joints 2" and below shall be ASTM F1960 cold-expansion joints with PEX-a reinforcing ring, installed per manufacturer's recommendations. PEX-a joints 2-½"-3" shall be SDR9 compression type fitting consisting of a double o-ring insert with a compression sleeve tightened around the pipe and insert. A factory-trained field representative shall provide on-site training for contractor's field personnel in the proper use of cold-expansion tools and installation of PEX-a piping product. Factory-trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.

3.5 PEX-COPPER TRANSITIONS/ELBOWS/SUPPORT MANIFOLDS TO FIXTURES

- A. Install copper to PEX elbows from behind finished walls to fixtures in accordance with manufacturer's recommendations and the A.H.J.'s requirements.
- B. Install Copper ELL manifold pipe support brackets per manufacturer's recommendations.

3.6 INSTALLATION OF THREADED CONNECTIONS

- A. Align threads at point of assembly.
- B. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.
- C. Assemble joint, wrench tight.

3.7 INSTALLATION OF FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.8 INSTALLATION AND TESTING OF PRESS FITTINGS AND COPPER TUBING

- A. Press connections: Press-seal fittings, ½-inch – 4-inch bronze, stainless steel or copper: Pipe ends shall be cut on a right angle (square) to the pipe. Pipe ends shall be reamed and chamfered, all grease, oil or dirt shall be removed from the pipe end with a clean rag. Visually examine the fitting sealing element to insure there is no damage, and it is properly seated into the fitting. Insert pipe fully into the fitting. Make a mark with a felt tip pen on the pipe at the face of the fitting. Always examine the tube to insure it is fully inserted into the fitting prior to pressing the joint. Press-seal fittings shall be installed according to the most current edition of the manufactures installation guidelines with manufacture recommended tools. Sealing elements shall be verified for the intended use. Installers shall attend the press-seal fitting manufactures installation training class. After Press fittings have been installed a “two step test” shall be followed. Utilizing air, or dry nitrogen, pressurize the system between .5 psi and 45 psi. Check the pressure gauge for pressure loss. If the system does not hold pressure, walk the system and check for un-pressed fittings. Should any un-pressed fitting/s be identified ensure the pipe is fully inserted into the fitting and properly marked prior to pressing the joint. After appropriate repairs have been made, test the system per local code, or specification requirements, not to exceed 200 psig.

3.9 INSTALLATION OF METERS, GAGES, THERMOMETERS, ETC.

- A. Meters/Gages
1. General: Where indicated, install meters and gages of types, sizes, capacities, and with features indicated.
 2. Install meters, gages, and accessories according to manufacturers' written instructions for applications where used.
 3. Install thermometers and adjust vertical and tilted positions.
 4. Remote-Reading Dial Thermometers: Install in control panels with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
 5. Thermometer Wells: Install in vertical position in piping tees where thermometers are indicated.
 - a. Install wells with stem extending minimum of 2 inches into fluid.
 - b. Install wells with stem extending to center of pipe.
 - c. Fill wells with oil or graphite and secure caps.
- B. Pressure Gages
1. Install pressure gages in piping tee with pressure gage face located on pipe at most readable position.
 2. Install in the following locations and elsewhere as indicated:
 - a. At suction and discharge of each pump.
 - b. At building water service entrance.
 - c. On expansion tanks.
 3. Needle Valves: Provide ¼" needle valve in piping tee, with snubber.
- C. Installation - Test Plug

1. Install test plugs in piping tees where indicated, located on pipe at most readable position. Secure cap.

D. Installation - Flow-measuring System, Flow Element And Meter

1. General: Install flow meters for piping systems located in accessible locations at most readable position.
2. Locations: Install flow measuring elements and meters at discharge of each pump and elsewhere as indicated.
3. Differential-Pressure-Type Flow Elements: Install minimum straight lengths of pipe upstream and downstream from element as prescribed by the manufacturer's installation instructions.
4. Install connection fittings for attachment to portable flow meters in readily accessible locations.
5. Permanently Mounted Meters for Flow Elements: Install meters on walls or brackets in accessible locations.
6. Install connections, tubing, and accessories between flow elements and meters as prescribed by manufacturer's written instructions.

E. Connections - Meters

1. Install meters and gages adjacent to machines and equipment to allow servicing and maintenance.
2. Connect flow-measuring-system elements to meters.
3. Connect flow-meter transmitters to meters.
4. Make electrical connections to power supply and electrically operated meters and devices.

F. Adjusting and Cleaning - Meters

1. Calibrate meters according to manufacturer's written instructions, after installation.
2. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.
3. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touchup paint.

G. Portable Meters

1. Turn-over portable meters to the Owner upon completion of the project.

3.10 INSTALLATION OF PIPING SPECIFIC TO DRAINAGE AND VENT SYSTEMS

A. Service Entrance Piping

1. Extend building storm drain piping and connect to building storm sewer piping of size and in location indicated for service entrance to building. Install cleanout and extension to grade at connection of building storm drain and building storm sewer.
2. Extend building sanitary drain piping and connect to sanitary sewer piping of size and in location indicated for service entrance to building. Install cleanout and extension to grade at connection of building sanitary drain and building sanitary sewer.
3. Install sleeve and mechanical sleeve seal at service penetrations through foundation wall for watertight installation.

B. General

1. Install cast-iron soil pipe and cast-iron soil pipe fittings according to the latest version of the CISPI "Cast Iron Soil Pipe and Fittings Handbook, 2006," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
2. Make changes in direction for drainage and vent piping using appropriate Y branches, Y branches with 1/8 bends, and long-sweep 1/4, 1/5, 1/6, 1/8, and 1/16 bends. Sanitary tees and short-sweep quarter vends may be used on vertical stacks of drainage lines where change in direction of flow is from horizontal to vertical. Use long-turn double-Y-branch and 1/8-bend fittings where 2 fixtures are installed back to back or side by side and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Make no change in direction of flow greater than 90°. Where different sizes of drainage pipes and fittings are connected, use proper size standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
3. Lay buried building drains beginning at low point of each system, true to grades and alignment indicated, with unbroken continuity of invert. Place hub or bell ends of piping facing upstream. Install required gaskets according to manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in piping and pull past each joint as completed.
4. Install sanitary piping, storm water piping, condensate drain piping, and vent piping at 2% slope, except where another slope is indicated.
5. Install underground PVC drainage piping according to ASTM D2321.
 - a. Rigid plastic and hubless drainage piping, including offsets and jumps, shall rest on a continuous bed of sand, gravel or crushed stone, a minimum of four (4) inches deep below the pipe; maximum aggregate size shall be three-quarter (3/4) inches (MD #6 and smaller). Bedding material shall be placed on both sides of the pipe equal in depth to the pipe diameter and hand compacted to prevent deformation of pipe from top loading. Piping shall be laid in a trench, except where soil conditions or grade do not permit such practices.
 - b. Drainage piping above grade and not fully confined within a trench shall rest on bedding material at least thirty (30) inches wide. Horizontal and vertical alignment of piping shall be maintained by three-eighths (3/8) inch minimum diameter steel "J" hooks, "U" hooks or equivalent hold-down devices driven into the ground every eight (8) feet, at changes of direction 45° or more, and at ends of runs. The length of hold-down devices shall be sufficient, depending on soil type, to prevent easy removal, but not less than twenty-four (24) inches long.
6. Sleeves are not required for cast-iron soil pipes passing through concrete slab, without membrane waterproofing, on grade.
7. Install ABS drainage pipe and fittings according to ASTM D2661.
8. Install PVC drainage pipe and fittings according to ASTM D2665.
9. Install all buried plastic pipe in accordance with ASTM D2321.

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

10. Joint Construction

- a. Grooved Pipe and Grooved-Pipe Fittings Joints: Assemble joints with coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- b. Cast-Iron Soil Pipe and Cast-Iron Soil Pipe Fitting Joints: Make joints according to recommendations in the latest version of the CISPI "Cast Iron Soil Pipe and Fittings Handbook, Volume I," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1) Compression Joint: Make with neoprene gasket matching class of pipe and fittings.
 - 2) Hubless Joint: Make with neoprene gasket and sleeve or clamp.
- c. ABS DWV Pipe: Join ABS drainage pipe and fittings according to ASTM D2661.
- d. PVC DWV Pipe: Join PVC drainage pipe and fittings according to ASTM D2665.
- e. ABS to PVC Transition Joints: Make nonpressure transition joint between ABS and PVC drainage components, using fittings, solvent cements, and procedure conforming to ASTM D3138.
- f. Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F402, for safe handling during joining of plastic pipe and fittings with solvent cements.

11. Pipe Attachments:

- a. Riser Clamps: MSS Type 8 or Type 42 for vertical runs.
 - b. Adjustable Steel Clevis Hangers: MSS Type 1 for individual straight horizontal runs 100 feet and less.
 - c. Adjustable Roller Hangers: MSS Type 43 for individual straight horizontal runs longer than 100 feet.
 - d. Spring Cushion Rolls: MSS Type 49, where indicated, for individual straight horizontal runs longer than 100 feet.
 - e. Pipe Rolls: MSS Type 44 for multiple straight horizontal runs 100 feet or longer. Support pipe rolls on trapeze.
 - f. Spring Hangers: MSS Type 52 for support of base of vertical runs.
12. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to the manufacturer's written instructions.
13. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.
14. Install Sweet Air odor eliminator vent caps on all sanitary vent terminations. Maintain 1-inch clearance between vent pipe and roof substrate.

C. Connections

1. Drainage Runouts to Fixtures: Provide drainage and vent piping runouts, with approved trap, of sizes indicated, but not smaller than required by plumbing code, to plumbing fixtures and drains.
 2. Locate drainage piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.
 3. Supply Runouts to Fixtures: Install hot- and cold-water supply piping runouts to fixtures of sizes indicated, but not smaller than required by plumbing code.
- a. Drainage Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but not smaller than required by plumbing code.

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

- b. Locate drainage piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.
 - 1) Solids Interceptors: Connect inlet and outlet.
- c. Electrical Connections: Power wiring and disconnect switches are specified in Division 26.
 - 1) Grounding & Bonding for Electrical Systems: Connect unit components to ground according to the National Electrical Code and Specification Section "Grounding."

D. Protection

- 1. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- 2. Place plugs in ends of uncompleted piping at end of day or when work stops.
- 3. Exposed ABS or PVC Piping: Protect plumbing vents exposed to sunlight with 2 coats of a water-based latex paint.

E. Drainage And Vent System Specialties

- 1. Install backwater valves in building drain piping as indicated. For interior installation, provide cleanout deck plate (cover) flush with floor and centered over backwater valve cover and of adequate size to remove valve cover for service.
- 2. Install expansion joints on vertical risers, stacks, and conductors as indicated.
- 3. Cleanouts
 - a. Install cleanouts in above-ground piping and building drain piping as indicated, and where not indicated, according to the following:
 - 1) Size same as drainage piping up to 4-inch size. Use 4-inch size for larger drainage piping except where larger size cleanout is indicated.
 - 2) Locate at each change in direction of piping greater than 45°.
 - 3) Locate at minimum intervals of 50 feet for piping 4 inches and smaller and 100 feet for larger piping.
 - 4) Locate at base of each vertical soil or waste stack.
 - b. Install cleanout deck plates (covers), of types indicated, with top flush with finished floor, for floor cleanouts for piping below floors.
 - c. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.
 - d. Install flashing flange and clamping device with each stack and cleanout passing through floors having waterproof membrane.
- 4. Floor Drain Installation
 - a. Install floor drains according to manufacturer's written instructions, in locations indicated.
 - b. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.
 - c. Trap drains connected to sanitary building drain. Provide trap primers for all traps.
 - d. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
 - e. Position drains for easy accessibility and maintenance.
- 5. Roof Drain Installation

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

- a. Install roof drains at low points of roof areas, according to the roof membranes manufacturer's installation instructions.
- b. Install drain flashing collar or flange so no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.
- c. Position roof drains for easy accessibility and maintenance.
6. Interceptor Installation
 - a. General: Comply with unit manufacturer's written instructions and with local authority for trapping and venting.
 - b. Install units with clear space for servicing.
 - c. Install waste piping, flow control fitting, vent piping, and accessories as indicated.
 - d. Above-Floor Installation: Set unit with bottom resting on floor, except where otherwise indicated.
7. Flashing Installation

F. Video Scope Complete Sanitary and Storm Water Drainage Systems

1. Prior to slab pour, video scope underground piping to assure no cracked or broken pipes under complete slab.
2. Video scope the completed plumbing drain pipe network, from the top floor to the property line, before setting fixtures and turning the building over to the owner.
3. Confirm no blockages exist
4. Provide video to owner through the submittal process

3.11 FIELD QUALITY CONTROL

- A. Division 01 Section: "Quality Requirements": Field inspecting, testing, adjusting, and balancing.
- B. Testing shall be performed by Installer of system being tested in presence of the Owner's representative. Provide seven (7) day advance notice prior to testing of systems.
- C. Inspection of Piping Systems:
 1. Do not enclose, cover, or put into operation any piping system until it has been inspected and approved by Owner's Representative.
 2. During progress of installation, notify the authority having jurisdiction seven (7) days prior to time such inspection must be made. Perform tests specified in presence of Owner's Representative.
 - a. Roughing-In Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures.
 - b. Final Inspection: Arrange for final inspection by Owner's Representative to observe tests specified below and to ensure compliance with requirements of Owner's Representative.
 3. Re-inspections: Make required corrections and arrange for reinspection by Owner's Representative when piping system fails to pass test or inspection.
 4. Reports: Prepare and submit inspection reports for approval by Owner's Representative.

PIPES AND TUBES FOR PLUMBING PIPING AND EQUIPMENT

- D. Test domestic water, sanitary waste, vent, and storm drainage piping systems in accordance with all applicable codes and the local authority having jurisdiction.

3.12 CLEANING (Division 22 Section: "Plumbing Piping System Cleaning and Treatment.")

3.13 PAINTING

- A. Touching Up: Clean field welds and abraded areas of paint. Use same materials as used for shop painting. Comply with SSPC-PA 1, "Shop, Field, and Maintenance Painting," requirements for touching up field painted surfaces.
 - 1. Apply 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.
- C. Plastic Pipe shall be painted with Exterior Grade Latex Paint. DO NOT USE EPOXY OR OIL BASE PAINTS ON PLASTIC PIPE.
- D. CPVC Piping: Paint coming into contact with pipe and fittings must be chemically compatible as per FBC System Compatibility Program. For products not listed on one of these program lists, consult the product manufacturer for compatibility with CPVC.

END OF SECTION

SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section, and the other sections of Division 22.

1.2 SUMMARY

- A. Section includes:
 - 1. Section includes single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.
 - 2. Source Quality Control.
 - 3. Bearing Protection Ring.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 22 Section: "Common Work Results for Plumbing."
 - 2. Division 22 Section: "Identification for Plumbing Piping and Equipment."
 - 3. Division 22 Section: "Plumbing Pumps."
 - 4. Division 26 Section: "Common Work Results for Electrical"
 - 5. Division 26 Section: "Grounding and Bonding for Electrical Systems."
 - 6. Division 26 Section: "Identification for Electrical Systems."

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generator.
- C. International Electrical Testing Association:
 - 1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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1.4 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.
- C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.
- D. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.
- B. Testing Agency: Company who is a member of the International Electrical Testing Association and specializing in testing products specified in this section with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Product storage and handling requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.
- C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.
- D. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR MOTORS

- A. General: Requirements below apply to motors covered by this Section except as otherwise indicated.
 - 1. Motors 3/4 hp and Larger: Three-phase motor as specified below.
 - 2. Motors Smaller Than 3/4 hp: Single-phase motor as specified below
 - 3. Frequency Rating: 60 Hz.

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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4. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
 - a. 120 V Circuit: 115 V - motor rating.
 - b. 208 V Circuit: 200 V - motor rating.
 - c. 240 V Circuit: 230 V - motor rating.
 - d. 480 V Circuit: 460 V - motor rating.
5. Minimum service factor shall be 1.15 and shall apply at frequency and utilization voltage at which motor is connected. Provide motors, which will not operate in service factor range when supply voltage is within 10 percent of motor voltage rating.
6. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100 percent of rated capacity.
7. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
8. Enclosure: Open dripproof, unless otherwise specified. Provide screen over slots, where slots will permit passage of human extremities.
9. Provide adjustable motor slide base for belt driven equipment. Include adjusting bolts and locknuts.
10. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.
11. Motors that operate with Variable Frequency Drives to meet the MG 1 Part 31 specifications with insulation that can withstand 1600 V peak voltage and a 1 msec rise time and improved bearing lubrication for higher temperature operation

B. Minimum nominal full load efficiency for NEMA design B motors shall be as follows:

	Open Motors			Enclosed Motors		
	2-pole	4-pole	6-pole	2-pole	4-pole	6-pole
HP	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
1	77.0	85.5	82.5	77.0	85.5	82.5
1.5	84.0	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91.0	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0

C. Minimum full load efficiency for polyphase small electric motors shall be as follows:

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

	Open Motors		
	2-pole	4-pole	6-pole
HP	3600 RPM	1800 RPM	1200 RPM
0.25	65.6	69.5	67.5
0.33	69.5	73.4	71.4
0.50	73.4	78.2	75.3
0.75	76.8	81.1	81.7
1.0	77.0	83.5	82.5
1.5	84.0	86.5	83.8
2.0	85.5	86.5	No Req.
3.0	85.5	86.9	No Req.

- D. Minimum full load efficiency for capacitor-start capacitor-run and capacitor-start induction-run small electric motors shall be as follows:

	Open Motors		
	2-pole	4-pole	6-pole
HP	3600 RPM	1800 RPM	1200 RPM
0.25	66.6	68.5	62.2
0.33	70.5	72.4	66.6
0.50	72.4	76.2	76.2
0.75	76.2	81.8	80.2
1.0	80.4	82.6	81.1
1.5	81.5	83.8	No Req.
2.0	82.9	84.5	No Req.
3.0	84.1	No Req.	No Req.

E. Three-phase Motors

1. NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
2. Insulation System: NEMA Class F.
3. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
4. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
5. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
6. Sound Power Levels: Conform to NEMA MG 1.

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

7. Multi-Speed Motors: Separate winding for each speed.
8. Variable Speed Motors for Use With Solid-State Drives: Energy efficient, squirrel-cage induction, design B units and ratings, characteristics, and features coordinated with and approved by drive manufacturer. Motors shall be labeled to indicate that they are provided with inverter duty capability in accordance with the National Electrical Manufacturers Association NEMA MG-1, Part 31.
9. Motors for Reduced Inrush Starting: Coordinate with indicated reduced controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.
10. All motors shall be provided with manufacturer's stamped nameplate, to include all pertinent and capacity data.

F. Single-phase Motors

1. General: Conform to the following requirements except as otherwise indicated.
2. Energy Efficient Motors: One of the following types as selected to suit the starting torque and other requirements of the specific motor application.
 - a. Permanent Split Capacitor.
 - b. Split-Phase Start, Capacitor-Run.
 - c. Capacitor-Start, Capacitor-Run.
3. Shaded-Pole Motors: Use only for motors smaller than 1/20 hp.
4. Internal Thermal Overload Protection for Motors: Protection shall automatically opens the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.
5. Bearings: Belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single phase motors.

2.2 SOURCE QUALITY CONTROL

- A. Test motors in accordance with National Electrical Manufacturers Association NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

2.3 BEARING PROTECTION RING

- A. All motors driven by a variable frequency PWM drive shall include a maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

- B. Provide AEGIS SGR Bearing Protection Ring as manufactured by Electro Statix Technology.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned motors.
- B. Maintain access to existing motors and other installations remaining active and requiring access.
- C. Clean and repair existing motors to remain or are to be reinstalled.

3.2 INSTALLATION

- A. General: The following requirements apply to field-installed motors.
 - 1. Install motors in accordance with manufacturer's published instructions and the following:
 - a. Direct Connected Motors: Mount securely in accurate alignment. Connect to driven equipment with coupler of appropriate type and material for the given duty. Coupler shall be selected for high and range of motor application.
 - b. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer recommendations.
- B. Install engraved plastic nameplates in accordance with Division 26.
- C. Ground and bond motors in accordance with Division 26.

3.3 FIELD QUALITY CONTROL

- A. Division 01 Section: "Quality Requirements": Field inspection, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.15.

PART 4 - VARIABLE FREQUENCY MOTORS

- A. Install Bearing Protection Ring in accordance with manufacturer's recommendations.

END OF SECTION

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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SECTION 22 05 23

GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section, and the other sections of Division 22.

1.2 SUMMARY

- A. Section includes:
 - 1. Globe valves
 - 2. Check valves.
 - 3. Ball valves.
 - 4. Butterfly valves.
 - 5. Drain valves.
 - 6. Lubricated plug valves.
 - 7. Valving specialties.
 - 8. Multi-purpose valves.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 22 Section: "Common Work Results for Plumbing."
 - 2. Division 22 Section: "Hangers and Supports for Plumbing and Equipment": Product and installation requirements for pipe hangers and supports.
 - 3. Division 22 Section: "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 - 4. Division 22 Section: "Plumbing Insulation": Product and installation requirements for insulation for valves.
 - 5. Division 22 Section: "Pipes and Tubes for Plumbing and Equipment": Product and installation requirements for piping materials applying to various system types.

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. References listed in this section:
 - 1. AGA (American Gas Association)
 - 2. ANSI (American National Standards Institute)
 - a. ANSI/ASME B16.34, Valves-Flanged, Threaded, and Welding End.

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- b. ANSI/API 600, Bolted Bonnet Steel Gate Valves for Petroleum and Natural Gas Industries.
- 3. API (American Petroleum Institute)
 - a. API 6D, Specification for Pipeline Valves.
 - b. API 594, Check Valves: Wafer, Wafer-Lig, and Double Flanged Type.
 - c. API 598, Valve Inspection and Testing.
 - d. API 607, Fire Test for Soft-Seated Quarter Turn Valves.
 - e. API 608, Metal Ball Valves- Flanged and But-Welding Ends.
 - f. API 609, Lug- and Wafer-Type Butterfly Valves.
- 4. ASME (American Society of Mechanical Engineers)
 - a. ASME A112.14.1, Back Water Valves.
 - b. ASME B16.10, Face to Face and End to End Dimensions of Valves.
- 5. ASSE (American Society of Sanitary Engineers)
 - a. ASSE 1013 Reduced Pressure Principle Backflow Preventors.
 - b. ASSE 1015, Double Check Backflow Prevention Assembly.
 - c. ASSE 1035, Laboratory Faucet Backflow Preventors.
- 6. ASTM (American Society for Testing and Materials)
 - a. ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - b. ASTM A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - c. ASTM B61, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
 - d. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - e. ASTM F 2389, Standard Specification for Pressure-rated Polypropylene (PP-R) Piping Systems.
 - f. ASTM D4101 - Standard Specification for Propylene Injection and Extrusion Materials.
- 7. IBC (International Building Code)
- 8. CSA (Canadian Standards Association)
- 9. IEEE (Institute of Electrical and Electronics Engineers)
- 10. IMC (International Mechanical Code)
- 11. IPC (International Plumbing Code)
- 12. MOSHA (Maryland Occupational Safety and Health Administration)
- 13. MSS (Manufacturers Standards Society of the Valve & Fittings Industry)
 - a. MSS SP-25, Standard Marketing System for Valves, Fittings, Flanges and Unions.
 - b. MSS SP-45, Bypass Drain Connections.
 - c. MSS SP-55, Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components.
 - d. MSS SP-61, Pressure Testing of Steel Valves.
 - e. MSS SP-67, Butterfly Valves.
 - f. MSS SP-68, High-Pressure Butterfly Valves with Offset Design.
 - g. MSS SP-70, Cast Iron Gate Valves Flanged and Threaded Ends.
 - h. MSS SP-71, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - i. MSS SP-72, Ball Valves with Flanged Fitting.

GENERAL DUTY VALVES FOR PLUMBING PIPING

- j. MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.
- k. MSS SP-80, Bronze Gate, Globe, Angle and Check Valves.
- l. MSS SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.
- m. MSS SP-110, "Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- 14. NEC (National Electrical Code)
- 15. NEMA (National Electrical Manufacturers Association)
- 16. NSF/ANSI 14 – Plastic Piping System Components and Related Materials
- 17. NSF/ANSI 61 & Annex G – Drinking Water Systems Components – Health Effects
- 18. NSF/ANSI 372 – Drinking Water Systems Components – Lead Content
- 19. OSHA (Occupational Safety and Health Administration)
- 20. UL (Underwriters' Laboratories)

1.4 DEFINITIONS

- A. Lead Free:
 - 1. The pipes, pipe fittings, plumbing fittings or fixtures in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooking, shall be "lead free", containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
 - 2. Solder and flux for soldered joints in potable water piping shall be "lead free", containing not more than 0.2% lead.
- B. PP-R – Polypropylene random pipe, a proprietary blend of polypropylene and glass fibers such as manufactured by Aquatherm and meeting the requirements of STM F2389.

1.5 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Requirements for Submittals.
- B. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
- C. Manufacturer's Installation Instructions: Submit hanging, support methods, and joining procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for Submittals.
- B. Project Record Documents: Record actual locations of valves.

- C. Operation and Maintenance Data: Submit installation instructions, spare parts list, explained assembly views.

1.7 QUALITY ASSURANCE

- A. Valves shall be provided by the same manufacturer when applicable.
- B. Grooved end valves shall be of the same manufacturer as the adjoining couplings.
- C. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.
- D. Material shall be certified by NSF International as complying with NSF 14, NSF 61, NSF 372 and ASTM F 2389 or CSA B137.11.
- E. Material shall comply with manufacturers specifications.
- F. Material and installation shall be in accordance with NFPA 99, and as specified.
- G. Perform work in accordance with AHJ requirements.
- H. "Hot taps" are not permitted for operating medical oxygen systems. Methods for connection and extension of active and pressurized medical gas systems without subsequent medical gas testing and verification are not allowed.
- I. Special Engineered products shall be certified by NSA International as complying with NSF 14.
- J. Lead Free:
 - 1. Valves in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooling, shall be "lead free" containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
 - 2. Solder and flux for soldered joints in potable water piping shall be "lead free", containing not more than 0.2% lead.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing work of this section with minimum 5 years experience.
 - 1. Installers of PP-R shall be certified by the piping manufacturer and shall carry their certification certificate cards with them at all times while on the project.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.

- B. Convene minimum one week prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Requirements for transporting, handling, storing and protecting products.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Prepare for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Set globe and gate valves closed to prevent rattling.
 - 3. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
 - 5. Block check valves in either closed or open position.
- E. Use the following precautions during storage:
 - 1. Store indoors and maintain temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store off the ground in watertight enclosures.
- F. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section: "Product Requirements": Environmental Conditions affecting products on site.
- B. Do not install valves underground when bedding is wet or frozen

1.12 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.13 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.
- B. Furnish two packing kits for each size valve.

PART 2 - PRODUCTS

2.1 VALVES - BASIC, COMMON FEATURES

- A. Pressure and Temperature Ratings: As indicated in the "Application Schedule" of Part 3 of this Section and as required to suit system pressures and temperatures.
- B. Sizes: Same size as upstream pipe, unless otherwise indicated.
- C. Operators: Use specified operators and handwheels, except provide the following special operator features:
 - 1. Chain-Wheel Operators: For valves 3 inches and larger, installed 120 inches or higher above finished floor elevation.
 - 2. Gear-Drive Operators: For valves 8 inches and larger. Operator shall be factory installed prior to delivery of job-site.
 - 3. Lever Operators: Ball and butterfly valves 10" and less.
- D. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
- E. Threads: ANSI/ASME B1.20.1.
- F. Flanges: ASME B16.1, ASME B16.5, and ASME B16.24.
- G. Hexagonal Threaded Packing Adjustment: All ball valves.
- H. Bypass and Drain Connections: Comply with MSS SP-45.
- I. Memory Stops: Provide memory stops for all "Balancing" valves.

2.2 VALVE APPLICATION SCHEDULE:

- A. Domestic Water:
 - 1. Globe Valves:
 - a. 1/8" through 2":
 - 1) Globe valves shall be class 250# CWP, rising stem, threaded bonnet, body with integral seat. The body, bonnet, union nut, disc holder & stem shall be ASTM B584 C89833, cast bronze (1/4" through 3/4" disc holder ASTM B16.) Bronze Disc. Hand wheel shall be Malleable iron. MSS SP-80, Type 2. Basis of Design: Milwaukee Model: UP502 (Threaded)

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Milwaukee Model: UP1502 (Sweat)
Conbraco Industries; Apollo Model 120 TF (Threaded)
Conbraco Industries; Apollo Model – 120 SLF (Sweat)
Other manufacturers: Hammond, Lunkenhimer

- 2) Design valves in accordance with requirements of ANSI NSF-372, Senate law S.3874.
2. Check Valves:
- a. Horizontal Swing ¼" through 2":
 - 1) Check valves shall be class, 200# CWP, horizontal swing check, body with 5° integral seat. Body, cap, & Disc shall be of ASTM, B584 C89833 cast bronze. (Disc on ¼" through ¾" ASTM B16) Lever, retaining ring, and Hinge Pin shall be stainless steel. Plug shall be ATSM B16, Lever, MSS SP-80, Type 3. Basis of Design:

Milwaukee Model: UP509 (Threaded)
Milwaukee Model: UP1509 (Sweat)
NIBCO Model: T413-Y-LF (Threaded)
NIBCO Model: S413-Y-LF (Sweat)
Conbraco Industries; Apollo Model – 163T-LF (Threaded)
Conbraco Industries; Apollo Model – 163S-LF (Sweat)
 - 2) Design valves in accordance with requirements of ANSI NSF-372, Senate law S.3874.
 - b. Spring Loaded "Silent" Lift- 3/8" through 2":
 - 1) Check valves shall be 250# CWP. ASTM B584 C89833, cast bronze body with integral seat, Tail Piece, & center guided disc holder. ASTM B104, bronze Spring. Buna or PTFE disc ring. Basis of Design:
Milwaukee Valve Figure Number UP548B (Threaded)
Milwaukee Valve Figure Number UP1548T (Sweat)
NIBCO Model: T480-Y-LF (Threaded)
NIBCO Model: S480-Y-LF (Sweat)
Conbraco Industries; Apollo Model – 61F-500 (Threaded)
Conbraco Industries; Apollo Model – 61F-600 (Sweat)
Other manufacturers: Hammond, Lunkenhimer
 - 2) Design valves in accordance with requirements of California AB1953 and Vermont S152.

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3. Ball Valves:

a. 1/4" through 2":

- 1) Ball valves shall be 600 CWP, ASTM B584 C89833, cast bronze two piece adapter loaded single reduced bore with chrome plated solid ASTM B16, brass tunnel drilled ball, blow-out proof brass stem, RPTFE 15% glass filled seats & thrust washer, PTFE packing, hexagonal threaded packing nut of ASTM B16, brass, Lever handle of Zinc plated steel with vinyl handle grip, MSS SP-110. Fed. Spec. WW-V-35C II, BZ, 3. Basis of Design:

Milwaukee Model: UPBA100 (Threaded)

Milwaukee Model: UPBA150 (Sweat)

NIBCO T/S 685-80-LF

Conbraco Industries; Apollo Model – 70LF 100 (Threaded)

Conbraco Industries; Apollo Model – 70LF 200 (Sweat)

Other manufacturers: Worcester, Hill McCena

- 2) Design valves in accordance with requirements of ANSI NSF 372, Senate Law S. 3874.

4. Hose End Drain Valves 1/2" and 3/4":

- a. Hose end drain valves shall be class 600# CWP, ASTM B584, cast bronze two piece adapter loaded single reduced bore with chrome plated solid ASTM B16, brass tunnel drilled ball, blow-out proof brass stem, RPTFE 15% glass filled seats & 25% glass filled thrust washer, PTFE packing, hexagonal threaded packing nut of ASTM B16, brass, Lever handle of Zinc plated steel with vinyl handle grip, ASTM B16, brass tail piece with standard hose end threads, brass bead chain and Zinc die cast cap, MSS SP-110, Fed. Spec. WW-V-35C II, BZ, 3. Basis of Design:

Conbraco Industries; Apollo Model – 70 HCLF

Milwaukee Model: UPBA 100 H (Threaded)

Milwaukee Model: UPBA 150 H (Sweat)

NIBCO Model: T585-70-HC (Threaded)

NIBCO Model: S585-70-HC (Sweat)

- b. Design valves in accordance with requirements of ANSI NSF 372, Senate Law S. 3874.

B. Water Service Drains:

1. Equipment Hose Bibbs:

- a. All valves at low points in piping systems used for drain valve duty shall be provided with brass or bronze valve body with threaded end connections,

GENERAL DUTY VALVES FOR PLUMBING PIPING

chromium plated ball, brass stem, RPTFE seats, seals and stuffing box ring, adjustable packing gland, valve handle, and three quarter (3/4") inch hose connection with cap and chain. All valves shall be as manufactured by Apollo, or Milwaukee. Valve model numbers shall be as listed below:

Apollo – 70 LF HC
Milwaukee - BA100H
NIBCO T/S 585-70-HC

2.3 VALVING SPECIALTIES

- A. Gas Solenoid Valves: Provide "normally closed" 2-way solenoid valve as manufactured by ASCO, or equivalent. Valves shall be UL and FM approved and labeled.
- B. Gas Pressure Reducing Valves: Valve shall be Sensus Model No. 243, or an acceptable comparable product with internal relief valve and capacities as indicated on the contract drawings. Size valve and springs to deliver scheduled pressures and gas flows.
 - 1. Pounds-to-inches line pressure regulators shall be available in several sizes:
 - a. REG 3: 1/2 inch threads
 - b. REG 5A: 3/4 inch threads
 - c. REG 7: 1-1/4 inch threads.
 - d. Regulators with Over Pressure Devices (OPD) are required for pressures above 2 psi. Regulators shall be listed per ASNI Z21.80 or a recognized national standard for pressure regulators. Regulators must be mounted in an accessible location.
 - 2. Regulators with included approved vent-limiting device (REG 3 and REG 5A) shall not require venting to atmosphere provided they are mounted in a ventilated location (e.g. near a gas appliance which also required placement in a ventilated area). Ventilated locations include (but are not limited to) mechanical rooms, attics, garages and basements.
 - 3. Approved vent limiters shall limit the fuel gas leakage to 2.5 cc per hour in the event of a diaphragm failure.
 - 4. Shut-off valves shall be approved for fuel gas service and shall be rated for the pressure of the gas piping system installed. For elevated pressure sections an approved valve shall be located upstream from the pounds-to-inches regulator.
 - 5. Overpressure protection devices shall be installed for elevated system higher than 2-PSI to prevent downstream pressure from exceeding 2-PSI in the event of regulator failure.
- C. Safety Relief Valves:
 - 1. Provide as manufactured by Conbraco Industries; Apollo Valve, Watts Regulator, Spence, or an acceptable comparable product.
 - 2. 125 psig working pressure and 250°F maximum operating temperature; designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code.
 - 3. Valve body shall be cast-iron.
 - 4. Valve shall have forged copper alloy disc, fully enclosed cadmium plated steel spring with adjustable pressure range and positive shut-off.

GENERAL DUTY VALVES FOR PLUMBING PIPING

5. Factory set valves to relieve at 10 psi above operating pressure.

D. Combined Pressure/Temperature Relief Valves:

1. Provide as manufactured by Conbraco Industries; Apollo Valve, Watts Regulator, Spence, or an acceptable comparable product.
2. Hydronic Systems: diaphragm operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment. Safety relief valve designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast-iron, with all wetted internal working parts made of brass and rubber; 125 psig working pressure and 250°F maximum operating temperature. Select valve to suit actual system pressure and Btu capacity. Provide with fast fill feature for filling hydronic system.

E. Domestic Hot Water Return Balancing Valve:

1. Manual Balancing:

- a. Provide ITT Bell & Gosset Manual Balancing Valve: Model CB, or acceptable comparable product as manufactured by NIBCO Model: 1710 Bal. Vlv.
- b. Valves shall be designed to allow installing contractor to pre-set balance points for proportional system balance prior to system start-up.
- c. All valves: 1/2", 3/4", 1", 1 1/4", 1 1/2" and 2" pipe sizes shall be of Lead Free Brass body/SS ball construction with glass and carbon filled TFE seat rings. Valves shall have differential pressure read-out ports across valve seat area. Read-out ports shall be fitted with internal EPT inserts/check valves. Valve bodies shall have 1/4" NPT tapped drain/purge port. Valves shall have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves shall have calibrated nameplates to assure specific valve settings. Valve shall be designed for positive shut-off.
- d. Valves shall be lead free.
- e. Automatic Flow Control Valve for Drinking Water Applications: 1/2 and 3/4", NSF/ANSI 61-G rated for commercial hot water service (temperature rated to 180F), and certified by the NSF with all wetted parts stainless steel; lead-free construction in compliance with NSF/ANSI-372; Series 300 stainless steel body, nickel plated brass union nut, and tamper-resistant flow cartridge 300 series stainless steel. Victaulic "ICSS" Series 76X.

2. Automatic Flow balancing:

- a. Provide IMI Flow Design ICSS or approved equal automatic flow limiting valve.
- b. The valve shall be certified lead free according to NSF 61 standards.
- c. The valve body shall be constructed out of 303 stainless steel.
- d. The flow for the valve shall be factory set and shall automatically limit flow to within ±5 percent.
- e. The valve shall be rated for 400 PSIG working pressure.
- f. Pressure loss shall not exceed 7 ft. wc.
- g. Install Balance Valve in accordance with manufacturer's instructions
- h. A venturi flow fitting shall be provided on the discharge side of the valve.

GENERAL DUTY VALVES FOR PLUMBING PIPING

F. Multi-Purpose Valves:

1. Valves shall be Bell & Gossett Model 3DV in sizes 1 – 2” and Model 3DS for sizes 2 ½” – 14” or comparable product as manufactured by TACO or Armstrong. With spring loaded check valve feature, isolation/shut off valve feature, and a calibrated balancing valve with nameplate and memory stop/button.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: “Administrative Requirements”: Verification of existing conditions before starting work.
- B. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- C. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- D. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
- E. Examine threads on valve and mating pipe for form and cleanliness.
- F. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- G. Examine grooved ends for form and cleanliness. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from valve/pipe end to groove.
- H. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION OF VALVES

- A. Valves shall be placed in such manner as to be easily accessible for smooth and easy handwheel operation and packing maintenance.
- B. Install valves in piping where shown and where listed herein:
 1. To balance flows in water piping systems.
 2. To isolate all items of equipment.
 3. To isolate branch lines and risers at mains.

4. To drain low points in piping systems.
 5. To drain pipe risers.
 6. To drain equipment.
- C. Where piping or equipment may be subsequently removed, provide valves with bodies having integral flanges or full lugs drilled and tapped to hold valve in place so that downstream piping or equipment can be disconnected and replaced with blank-off plate while valve is still in service.
- D. Valves for equipment and controls shall be installed full size of pipe before reducing size to make equipment connection.
- E. Where there is not interference, gate and globe shut-off valves shall be installed with handwheel up on horizontal runs of pipe to prevent accumulation of foreign matter in working parts of valves. In no case shall the stem be installed below the pipe centerline.
- F. Butterfly valves shall be installed with handle position in the horizontal position: i.e., butterfly pivot point parallel with the floor.
- G. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
- H. Install valves in a position to allow full handle movement.
- I. For chain-wheel operators, provide chains to 60 inches above finished floor elevation.
- J. Installation of Check Valves: Install for proper direction of flow as follows:
1. Swing Check Valves: Horizontal position with hinge pin level.
 2. Lift Check Valve: With stem upright and plumb.
 3. Install check valves on each pump discharge and elsewhere as required to control flow direction.
- K. Install drain valves at low points in mains, risers, branch lines, and everywhere else required to permit drainage of the entire system.
- L. Install shut-off valves on natural gas and compressed air systems upstream of each pressure regulator. Where two pressure regulators are installed in series in a single line, a manual valve is not required at the second regulator.
- M. Install pump discharge valves with stem in upward position.
- N. Install safety relief valves on hot water generators, boilers, pressure vessels, etc. and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge without valves as shown on drawings or to nearest floor drain if not shown on drawings. Comply with ASME Boiler and Pressure Vessel Code Section VIII, Division 1 for installation requirements.
- O. Provide balancing valves as shown on drawings and as required to permit complete balancing of all systems.
- P. Provide access where valves and fittings are not accessible.

GENERAL DUTY VALVES FOR PLUMBING PIPING

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- Q. Install spring loaded check valves on discharge of water pumps.
- R. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

3.3 INSTALLATION OF THREADED CONNECTIONS

- A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.
- B. Align threads at point of assembly.
- C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.
- D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.4 INSTALLATION OF FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.5 INSTALLATION OF VALVING SPECIALTIES SPECIFIC TO WATER SYSTEMS

- A. Install pump discharge valves in horizontal or vertical position with stem in upward position. Allow clearance above stem for check mechanism removal.
- B. Install pressure-regulating and reducing valves with inlet and outlet shutoff valves and balance valve bypass. Install pressure gage on valve outlet and install valved bypass where indicated. Install unions at inlet and outlet connections.
- C. Install hose bibbs with integral or field-installed vacuum breaker.
- D. Install trap seal primer valves with valve outlet piping pitched down toward drain trap a minimum of 1/8" inch per foot (1 percent) and connect to floor drain body, trap, or inlet fitting. Adjust valve for proper flow.
- E. Adjusting
 - 1. Adjust operation and correct deficiencies discovered during commissioning.

- a. Electrical Connections: Power wiring and disconnect switches are specified in Division 26
- b. Grounding & Bonding for Electrical Systems: Connect unit components to ground according to the National Electrical Code and Specification Section "Grounding."

3.6 INSTALLATION OF VALVES SPECIFIC TO GAS PIPING SYSTEMS

- A. Install natural gas piping in accordance with NFPA 54.
- B. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.
- C. Install gas pressure regulator vent full size of opening on regulator and terminate outdoors

3.7 ADJUSTING VALVES

- A. VALVES: Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

END OF SECTION

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HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and the other Sections of Division 22.

1.2 SUMMARY

A. General Requirements:

1. Incorporate in construction pipe hangers and supports to manufacturer's recommendations utilizing manufacturer's regular production components, parts, and assemblies.
2. Comply with maximum load ratings with consideration for allowable stresses prescribed by ASME B31.1 or MSS SP-58.
3. Provide support, guides and anchors that do not transmit unacceptable heat and vibration to building structure.
4. Installation of pipe hangers and supports shall be based upon the overall design concept of the piping system. The support system shall provide for an control the free movement of piping including its movement in relation to that connected equipment.
5. Provide for vertical adjustments after installation of supported material and during commissioning, where feasible, to ensure pipe is at design elevation and slope.

B. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Acoustical Sealant
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Equipment bases and supports.

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

1. Division 03 Section: "Concrete Forming and Accessories": Execution requirements for placement of inserts in concrete forms specified by this section.
2. Division 03 Section: "Cast-In-Place Concrete" : Execution requirements for placement of concrete housekeeping pads specified by this section.

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3. Division 07 Section: "Joint Protection": Product requirements for sealant materials for placement by this section.
4. Division 09 Section: "Painting and Coating": Product and execution requirements for painting specified by this section.
5. Division 22 Section: "Common Work Results for Plumbing".
6. Division 22 Section: "Plumbing Insulation".
7. Division 22 Section: "Pipes and Tubes for Plumbing Piping and Equipment": Execution requirements for placement of hangers and supports specified by this section.
8. Division 22 Section: "Vibration and Seismic Controls for Plumbing Piping and Equipment": Product and execution requirements for vibration isolators.

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. American Society of Mechanical Engineers:
 1. ASME B31.1 - Power Piping.
 2. ASME B31.5 - Refrigeration Piping.
 3. ASME B31.9 - Building Services Piping.
- B. ASTM International:
 1. Structural Steel: ASTM A 36/A 36M, "Carbon Structural Steel," steel plates, shapes, and bars, black and galvanized.
 2. Bolts and Nuts: ASME B18.10 or ASTM A 183, "Track Bolts and Nuts," steel, hex-head, track bolts and nuts.
 3. Grout: ASTM C 1107, Grade B, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)," non-shrink, nonmetallic.
 4. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
 5. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
 6. ASTM F708 - Standard Practice for Design and Installation of Rigid Hangers.
 7. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
 8. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.
 9. Washers: ASTM F 844, "Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use," steel, plain, flat washers.
- C. American Welding Society:
 1. AWS D1.1 - Structural Welding Code - Steel.
- D. FM Global:
 1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
- E. Manufacturers Standardization Society of the Valve and Fittings Industry:
 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

2. MSS SP 69 - Pipe Hangers and Supports – C Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
4. MSS SP 90 – Valves and Fittings Standards.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.4 DEFINITIONS

(Unless otherwise noted, references apply to “latest editions.”)

- A. Terminology used in this Section is defined in Manufacturer’s Standardization Society Specification - 90, Valve and Fittings Standards.
- B. PP-R-Polypropylene random pipe, a proprietary blend of polypropylene and glass fibers such as manufactured by Aquatherm and meeting the requirements of ASTM F2389.
- C. Pex Piping: Cross linked polyethylene, is cross linked HDPE (High Density Polyethylene), it is melted and continuously extruded into tubing.
- D. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 SUBMITTALS

- A. Division 01 Section: “Submittal Procedures”: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

- E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods sealed by a registered professional engineer.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Firestopping Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.
- I. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- J. Submission of samples may be requested for each type of hanger device. After approval, samples shall be returned for installation at job site.
- K. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 QUALITY ASSURANCE

(Unless otherwise noted, references apply to "latest editions.")

- A. NFPA Compliance: Comply with NFPA 13, "Installation of Sprinkler Systems," for hangers and supports used as components of fire protection systems.
- B. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70 "Definitions."
 - 1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, "Definition and requirements for a nationally recognized testing laboratory."
- C. Licensed Operators: Use operators that are licensed by powder-operated tool manufacturers to operate their tools and fasteners.
- D. Supply and install incidental materials needed to meet requirements, even if not expressly specified or shown on drawings without claim for additional payment.
- E. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.

- F. Should any rotating equipment cause excessive noise or vibration, rebalance, realign or do other remedial work to reduce noise and vibration levels. Excessive is defined as exceeding manufacturer's specifications for unit in question.
- G. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- H. Through Penetration Firestopping of Non-Fire Rated Floor and Roof assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- I. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.
- J. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.
- K. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- L. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing Work of this section with a minimum of five years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.

- B. Convene minimum one week prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Division 01 Section: "Product Requirements" for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section: "Product Requirements": Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air is not in accordance with the manufacturer's installation procedures.
- C. Maintain manufacturer's required temperature before, during, and after installation of firestopping materials for minimum periods of time as required by the manufacturer.
- D. Provide ventilation in areas to receive solvent cured materials.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

(Unless otherwise noted, references apply to "latest editions.")

MATERIALS

- A. Structural Steel: ASTM A 36, "Carbon Structural Steel," steel plates, shapes, and bars, black and galvanized.

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- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, "Track Bolts and Nuts," steel, hex-head, track bolts and nuts.
- C. Washers: ASTM F 844, "Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use," steel, plain, flat washers.
- D. Grout: ASTM C 1107, Grade B, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)," non-shrink, nonmetallic.
 - 1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is non-staining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Water: Potable.
 - 4. Packaging: Premixed and factory-packaged.

2.2 PIPE HANGERS AND SUPPORTS

- A. Hangers, Supports, and Components: Provide factory-fabricated products as manufactured by B-Line, AITT Grinnel, Pipe Shields, Inc., or Erico CADDY. Basis of Design shall be B-Line.
 - 1. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
 - 2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
 - 3. Pipe attachments shall include vinyl coated or felt lined where attachments are in direct contact with Polypropylene ((PP-R) piping systems.
- B. Upper attachments to structures shall have an allowable load not exceeding 3 of the failure (proof test) load but are not limited to the specific methods indicated.
- C. Horizontal Non-Insulated Waste, Vent and Storm Water Piping Hangers:
 - 1. Two inch and smaller: Figure No. B3170.
 - 2. Two and one-half inch and larger: Figure No. B3100.
- D. Horizontal Non-Insulated Copper Piping Hangers:
 - 1. Two inches and smaller: Figure No. B3104 CTC.
 - 2. Two and one-half inch and larger: Figure No. B3104 CT.
- E. Horizontal Non-Insulated Pex Piping Hangers:
 - 1. One inch to two inch: Figure No. B3104 CTC with Uponor Pex – pipe support or equal, installed per manufacture's recommendations.
 - 2. Two and one-half inch to three inch: Figure No. B31065 with No. B3106V channel, plastic coated.
 - 3. For piping 1 inch and smaller, use continuous support system or support per manufacturer's recommendations.

- F. Insulated Horizontal Piping hangers; Cold and Hot Water (Domestic)
 - 1. Two inches and smaller: Figure No. B3108 with metal shield, Figure No. B3151.
 - 2. Two and one-half inches and larger: Figure No. B3108 with metal shield, Figure No. B3151.
- G. Vertical Piping Riser Clamps:
 - 1. Copper Pipe: Figure No. B3373CT.
 - 2. Steel Pipe: Figure No. B3136 and B3137.
- H. Hangers for Brass Piping or to Eliminate Electrolytic Action:
 - 1. Figure No. B3104C.
- I. Beam Clamps and Attachments:
 - 1. For bolt-on locations to structure, Figure Nos. B3291, B3036, or B3050.
 - 2. Welded beam attachments, Figure No. B3083.
- J. Brackets:
 - 1. For equipment and piping adjacent to walls or steel columns, Figure Nos. B3066, B3063 and B3067 depending on weight to be supported.
- K. Pipe Rests:
 - 1. For pipes close to floor where no expansion provision is required, Figure No. B3088T base stand with B3093 adjustable pipe saddle support.
- L. Hanger Rods:
 - 1. Hanger rod, Figure No. B3205.
 - 2. Continuous threaded rod, Figure No. ATR.
 - 3. Eye rods, Figure No. B3210 or B3211, depending on load supported.
- M. Trapeze Hangers - Direct Mounting Hangers:
 - 1. Grinnell, Figure No. 46.
- N. Protection Saddles:
 - 1. Cast iron pipe, insulated, Figure No. B3108 with metal shield, Figure No. B3151.
 - 2. For high temperature steel pipe, insulated, No. B3160, B3161, B3162, B3163, B3164, or B3165.
- O. Pipe Roll Stands:

1. For support of pipe where axial movement is encountered: Figure No. B3117SL where no vertical adjustment is required; and Figure No. B3118SL where vertical adjustment is required.
- P. Horizontal AWWA Piping (Flanged or Bell-spigot) Hangers:
 1. Cast iron pipe, Figure No. B3102.

2.3 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.4 INSERTS

- A. Hangers, Supports, and Components: Provide factory-fabricated products as manufactured by B-Line, AITT Grinnel, Pipe Shields, Inc., or Erico CADDY. Basis of Design shall be B-Line.
- B. Thermal-Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate or treated lumber inserts, encased with sheet metal shield. Insert and shield cover entire circumference of pipe and are of length indicated by manufacturer for pipe size and thickness of insulation.
- C. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.
- D. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used. Fasteners for fire protection systems include UL listing and FM approval.
- E. Concrete Inserts:
 1. For concrete spot inserts at single locations for casting into structure, Figure No. B3014 for pre-determined rod size and Figure No. B2500 for universal use.
 2. For continuous slot concrete insert at multi-locations for casting into structure, Figure No. B2505.
- F. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.5 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.

- C. Lead Flashing:
 - 1. Waterproofing: 5 lb./sq. ft sheet lead.
 - 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sealant: Acrylic.

2.7 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.8 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.9 ACOUSTICAL SEALANT

- A. Sealants for acoustical purposes shall be one of following non-setting sealants:

Acoustical sealant D.A.P.
BR – 96.....Pecra
Acoustical sealant.....Tremco
Acoustical sealant U.S.G.

2.10 NO-HUB FITTING RESTRAINTS

- A. Provide Holdrite model #117-LL or approved comparable product series no-hub fitting restraints in accordance with the installation instruction of US cast iron soil pipe manufacturers. CISPI designation 310-11 and the 20006 CISPI installation handbook. The system shall restrain (2) 45 degree 1/8 bend onto the adjoining pipe. The system shall be stainless steel bands that meet a torque of 60 in/lbs minimum. The restraint system shall meet a thrust pressure rating equal to 50 feet of head of water pressure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements": Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.
- B. Install damming materials to arrest liquid material leakage.
- C. Remove incompatible materials affecting bond.
- D. Drilling or cutting of structural members shall be as detailed / directed by structural engineer.

3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

(Unless otherwise noted, references apply to "latest editions.")

A. General

1. Comply with MSS SP-69 and SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Piping shall be supported independently from equipment connections. Supports shall not interfere with removal of equipment.
2. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.
3. Install supports with maximum spacings complying with MSS SP-69.
4. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
5. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69, "Pipe Hangers and Supports C Selection and Application." Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts in new construction prior to placing concrete. Install reinforcing bars through openings at top of inserts.
6. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.
7. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches thick.
8. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
9. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.
10. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
11. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
12. Place hangers within 12 inches of each horizontal elbow.
13. Use hangers with 1-1/2 inch minimum vertical adjustment.
14. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
15. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
16. Support riser piping independently of connected horizontal piping.
17. Provide copper plated hangers and supports for copper piping.
18. Design hangers for pipe movement without disengagement of supported pipe.
19. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
20. Provide clearance in hangers and from structure and other equipment for installation of insulation.

21. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
22. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9, is not exceeded.
23. Insulated Piping: Provide continuous insulation and vapor barrier through hangers and supports. Comply with the following installation requirements.
24. Riser Clamps: Attach riser clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9. Insulate clamps on piping with insulation and vapor barrier.
25. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
26. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees and have dimensions in inches not less than the following:

NPS (Inches)	LENGTH (Inches)	THICKNESS (Inches)
1/4 to 3 1/2	12	0.048
4	12	0.060

27. Pipes 4 Inches and Larger: Include treated wood inserts.
28. Insert Material: Length to equal to the length of the protective shield.
29. Conform to the table below for maximum spacing of supports and rod sizes:

a. Steel and Copper Pipe:

Nom. Pipe Size – In.	Steel Pipe Max. Span – Ft.	Copper Tube Max. Span – Ft.	Min. Rod Dia. – In.
Up to 3/4	7	5	3/8
1	7	6	3/8
1 1/4	7	7	3/8
1 1/2	9	8	3/8
2	10	8	3/8
2 1/2	11	9	1/2
3	12	10	1/2
3 1/2	13	11	1/2
4	14	12	5/8 (1/2 for copper)

- b. Support vertical steel pipe and copper tube at each floor.
30. Pex-a-Pipe:

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

31. Pex-a-Piping Hanger Spacing: Install hangers for Pex-a-Piping with the flow maximum spacing:
 - a. 1-inch and below: maximum span, 32 inches.
 - b. 1-1/4 inch and above: maximum span, 48 inches.
32. Pex-a-Piping Hanger Spacing with Uponor Pex-a-Piping Support Channel:: Install hangers for Pex-a-Piping with horizontal support channel with the following maximum spacing:
 - a. Maximum span, 8 feet.
33. Polypropylene and RO/DI Piping:
 - a. Support plastic pipe and tubing in accordance with manufacturer's recommendations. Maximum spacing between hangers: 3'-0".
34. Plastic Piping:

Pipe Material	Horizontal In Feet	Vertical In Feet
ABS Plastic Pipe	4	4
Cast-Iron Soil Pipe	5	15
CPVC Plastic Pipe	3	3
PVC Plastic Pipe	4	4

- a. Support plastic pipe and tubing in accordance with manufacturer's recommendations.
 - b. Support cast-iron piping at each hub.
35. Equipment Supports:
 - a. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.
 - b. Grouting: Place grout under supports for equipment and concrete bases. Make a smooth bearing surface.

3.5 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe 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 manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and the following:

- D. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- E. Obtain fusion without undercut or overlap.
- F. Remove welding flux immediately.
- G. Finish welds at exposed connections so that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.6 PAINTING

- A. Touching Up: Clean field welds and abraded areas of factory paint and paint exposed areas immediately after erection of hangers and supports. Use same materials as used for factory painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- B. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- C. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of factory paint on miscellaneous metal is specified in Division 09 Section "Painting and Coating".
- D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.7 APPLICATIONS FOR HANGER AND SUPPORT

- A. Specific hanger requirements are specified in the Section specifying the equipment and systems.
- B. Comply with MSS SP-69, for pipe hanger selections and applications that are not specified in piping specification Sections.

3.8 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3 1/2" thick and extending 6" beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Division 22 Section: "Vibration and Seismic Controls for Plumbing and Equipment."

3.9 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor drains and floor sinks watertight to adjacent materials.
- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.10 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.
- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install stainless steel escutcheons at finished surfaces.

3.11 FIELD QUALITY CONTROL

- A. Division 01 Section: "Quality Requirements": Requirements for inspecting, testing.
- B. Inspect installed firestopping for compliance with specifications and submitted schedule.
- C. Licensed Engineer's Report: Prepare hanger and support installation report. Include seal and signature of Registered Engineer, licensed in jurisdiction where Project is located, certifying compliance with specifications.

3.12 CLEANING

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.13 PROTECTION OF FINISHED WORK

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for protecting finished work.
- B. Protect adjacent surfaces from damage by material installation.

3.14 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Adjust for pipe alignment and final equipment connections. Flexible connections shall not be used for adjustment of alignment.

3.15 NO-HUB FITTING RESTRAINTS

- A. A. Shall be installed at the base on all drainage risers.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section, and the other sections of Division 022.

1.2 SUMMARY

- A. Section Includes:

Engraved Plastic-Laminate Signs.

1. Valve Tags.
2. Painted Identification Materials.
3. Plastic Pipe Markers.
4. Ceiling Tacks
5. Plasticized Tags.

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

1. Division 09 Section: "Painting and Coating": Execution requirements for painting specified by this section.
2. Division 22 Section: "Common Work Results for Plumbing."
3. Division 22 Section: "Plumbing Pumps."
4. Division 22 Section: "Pipes and Tubes for Plumbing Piping and Equipment."
5. Division 22 Section: "General Duty Valves for Plumbing Piping."
6. Division 22 Section: "Plumbing Fixtures."

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. American Society of Mechanical Engineers:

1. ASME A13.1 - Scheme for the Identification of Piping Systems.

- B. National Fire Protection Association:

1. NFPA 99 - Standard for Health Care Facilities.

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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1.4 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- E. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8 1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. Furnish copies for Maintenance Manuals as specified in Division 01 Section: "Execution and Closeout Requirements."
- F. Maintenance Data: Include product data and schedules in maintenance manuals, in accordance with requirements of Division 01.
- G. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- H. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- I. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements": Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1, for lettering size, length of color field, colors, and viewing angles of identification devices.

2. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

C. Equipment Lettering and Graphics:

1. General: Coordinate names, abbreviations and other designations used in plumbing identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of plumbing systems and equipment.
 - a. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification, which indicates individual system number as well as service (for example; Water Heater No. 3).

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements:": Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 EXTRA MATERIALS

- A. Division 01 Section: "Execution and Closeout Requirements": Spare parts and maintenance products.
- B. Furnish two containers of spray-on adhesive

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification materials which may be incorporated in the work include, but are not limited to, the following:
- B. Manufacturer: Subject to compliance with requirements, provide plumbing identification materials of one of the following:
1. Brady (W.H.) Co.; Signmark Div.
 2. Industrial Safety Supply Co., Inc.
 3. Seton Name Plate Corp.

2.2 MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.
- B. Provide pipe markers with the following background colors and designations:

SERVICE	STENCIL DESIGNATION	LETTER COLOR	BACKGROUND COLOR	JACKET
Sanitary/Vent	Sanitary Sewer/Vent	White	Safety Green	Brown
Domestic Cold Water	Domestic Cold Water	White	Safety Green	Blue
Domestic Hot Water	Domestic Hot Water (F)	White	Safety Green	Red
Domestic Hot Water Return	Domestic Hot Water Return (F)	White	Safety Green	Red
Condensate Drain	Drain Water	White	Safety Green	Tan

2.3 ENGRAVED PLASTIC-LAMINATE SIGNS (Nameplates):

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and

wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

- B. Thickness: 1/8", except as otherwise indicated.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- D. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - 1. Name and plan number.
 - 2. Equipment service.
 - 3. Design capacity.
 - 4. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.
- E. Size: Provide approximate 2 1/2" x 4" markers for control devices, dampers, and valves; and 4 1/2" x 6" for equipment.

2.4 VALVE TAGS:

- A. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
 - 1. Provide 1 1/2" sq. black tags with white lettering, except as otherwise indicated.
 - 2. Provide size, shape and color combination as specified or scheduled for each piping system.
- B. Plastic Valve Tags: Provide manufacturer's standard solid plastic valve tags with printed enamel lettering, with piping system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8" high, and with 5/32" hole for fastener.
 - 1. Provide 1 1/8" sq. white tags with black lettering.
 - 2. Provide size, shape and color combination as specified or scheduled for each piping system.
- C. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- D. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame

2.5 PAINTED IDENTIFICATION MATERIALS:

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
 - 2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
 4. Ductwork and Equipment: 1-3/4 inches high letters
- B. Stencils shall not be utilized on piping and plumbing equipment.
- C. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
- D. Identification Paint and Background Color; Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems and plumbing equipment comply with ANSI A13.1 for colors.

2.6 PLASTIC PIPE MARKERS:

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, UV-resistant color-coded pipe markers, complying with ANSI/ASME A13.1
- B. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 2. Adhesive lap joint in pipe marker overlap.
 3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1 1/2".
- C. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
1. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1 1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
 2. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
- D. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.
1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.7 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color-coded head.
- B. Color code as follows:
1. Plumbing valves: Green.

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

2.8 PLASTICIZED TAGS:

- A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3 1/4" x 5 5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

- A. General:
 - 1. Coordination: Where identification is to be applied to surfaces, which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
 - 2. Confined Spaces: Provide labels and signs on all duct and equipment doors, plenums, etc. to indicate service and provide operator warnings as required by OSHA, NFPA, and authority having jurisdiction.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- D. Piping System Identification:
 - 1. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - a. Plastic pipe markers, with application system as indicated under "Materials" in this section.
 - 2. Locate pipe markers and color bands as follows on all piping in occupied spaces, above ceilings, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - c. Near locations where pipes pass through walls or floors/ ceilings, or enter non-accessible enclosures.

- d. At access doors, manholes and similar access points, which permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced intermediately at maximum spacing of 25' along each piping run, except reduce spacing to 10' in congested areas.
 - 1) All exposed natural gas piping, > 0.5 PSIG shall be marked at intervals not exceeding 5 feet.
 - 3. Non-Potable Water Identification:
Change Summary: Whenever nonpotable water systems are installed, including outside of the building, the piping must be identified.
 - a. Where nonpotable water systems are installed, the piping conveying the nonpotable water shall be identified either by color marking or metal tags in accordance with plumbing code. All nonpotable water outlets such as hose connections, open-ended pipes, and faucets shall be identified at the point of use for each outlet with the words, "Nonpotable-not safe for drinking." The words shall be indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material or shall be indelibly printed on the fixture. The letters of the words shall be not less than 0.5 inches in height and in colors in contrast to the background on which they are applied.
 - b. All systems and outlets for nonpotable water should be identified regardless of location.
 - 4. Labeling of water distribution pipes in bundles:
 - a. Where water distribution piping is bundled at installation, each pipe in the bundle shall be identified per project specification. The identification shall indicate the pipe contents and the direction of flow in the pipe. The interval of the identification markings on the pipe shall not exceed 25 feet. There shall be not less than one identification label on each pipe in each room, space, or story.
 - 5. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 foot spacing.
- E. Valve Identification:
- 1. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures. List each tagged valve in valve schedule for each piping system.
- F. Equipment Identification:
- 1. General: Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Water meters and flow meters.
 - c. Fuel-burning units.
 - d. Pumps, compressors, and similar motor- driven units.
 - e. Heat exchangers, expansion tanks, and similar equipment.

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- f. Tanks and pressure vessels.
 - g. Filters, water treatment systems and similar equipment.
 - h. Domestic water heater, RO/DI equipment, vacuum pump units, sumps, sewage ejectors, etc.
 - 2. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
 - 3. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety precautions, and warn of hazards and improper operations.
- G. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 ADJUSTING

- A. Adjusting: Relocate any identification device, which has become visually blocked by work of this division or other divisions.

3.4 CLEANING

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for cleaning.
- B. Cleaning: Clean face of identification devices.

3.5 EXTRA STOCK

- A. Furnish minimum of 5% extra stock of each identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
 - 1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

END OF SECTION

SECTION 22 05 93
TESTING, ADJUSTING AND BALANCING FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and the other Sections of Division 22.

1.2 SUMMARY

- A. Coordinate work of this section with all trades.
- B. Work covered in this Section shall be performed after completion of work specified in all Divisions as they related to this work.
- C. Review of design drawings and specifications, and comment on potential problem areas.
- D. Site inspections of ongoing plumbing installation with written report from each visit.
- E. Measurement and setting of all domestic hot water systems provided or specified in accordance with these contract documents, recording data, making tests, and preparing reports, all as hereinafter specified.
- F. Coordinate with all trades to provide all incidental items not indicated on drawings or in specifications that belong to work described or are required for complete systems balancing, at no additional cost to Owner.
- G. Refer to paragraph "Closeout Submittals" in Division 22 Section: "Common Work Results for Plumbing."

1.3 SUBMITTALS

(Unless otherwise noted, references apply to "latest edition".)

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Agency Data:
 - 1. Submit proof that proposed testing, adjusting, and balancing agency meets the qualifications specified within 30 days of award of contract.
- C. Engineer and Technicians Data:

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1. Submit proof that Test and Balance Engineer assigned to supervise procedures, and technicians proposed to perform procedures meet qualifications specified within 30 days of award of contract.
- D. Procedures and Agenda: Submit synopsis of testing, adjusting, and balancing procedures and agenda proposed to be used for this project within 90 days of award of contract.
- E. Document Review:
 1. Submit certification in writing that all design drawings and specifications have been reviewed, and comment on potential problems within 90 days of award of contract.
- F. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 01 and Division 22 Section: "Common Work Results for Plumbing."
- G. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of Test and Balance Engineer. Reports shall be certified proof that systems have been tested, adjusted, and balanced in accordance with referenced standards; are an accurate representation of how systems have been installed; are true representation of how systems are operating at completion of testing, adjusting, and balancing procedures; and are accurate record of final quantities measured, to establish normal operating values of the systems. Follow procedures and format specified below:
 1. Report Format: Report forms shall be those standard forms prepared by referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Divide contents of binder into divisions listed below, separated by divider tabs:
 - a. General Information and Summary
 - b. Domestic hot Water Systems
 - c. Automatic Temperature Controls
 - d. Special Systems
 2. Report Contents: Provide following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Include certification sheet containing seal and name address, telephone number, and signature of Certified Test and Balance Engineer. Include in this division listing of the instrumentations used for the procedures along with proof of calibration.
 - b. Remainder of the report shall contain appropriate forms containing as minimum, information indicated on standard report forms prepared by AABC and NEBB, for each respective item and system. Prepare schematic diagram for each item of equipment and system to accompany each respective report form.

- H. NIST Calibration Reports: Submit proof that all testing and balancing instruments and equipment used for this project has been calibrated in accordance with NIST Standards, within period of twelve months prior to starting project.
- I. Final submittal shall include but not be limited to following:
 - 1. List of equipment used to perform test and procedures.
 - 2. Equipment performance data and equipment curves with actual points of performance indicated on curves as compiled during balancing.
 - 3. Domestic hot water system component flow rates, pressures and temperatures.
 - 4. On balance report documents record date and time of reading.
- J. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.4 QUALITY ASSURANCE

(Unless otherwise noted, references apply to “latest edition”)

- A. Agency Qualifications:
 - 1. Employ services of independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance the building domestic hot water systems to produce design objectives. Services shall include checking installations for conformity to design, measurement and establishment of fluid quantities of plumbing systems as required to meet design specifications, and recording and reporting results.
 - 2. Certified by National Environmental Balancing Bureau (NEBB) or by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in State in which services are to be performed, certified by NEBB or AABC as Test and Balance Engineer.
- B. Work shall be accomplished in accordance with specifications. Procedures specified shall be followed and, if not specifically described herein, in general, shall be in accordance with Associated Air Balance Council's National Standards or National Environmental Balancing Bureau's Procedural Standards.
- C. Design Review:
 - 1. Review all design drawings and specifications. Review shall include:
 - a. Control device location and balancing devices location in piping systems.
 - b. Indicate additional balancing devices required for proper balancing.
 - c. Specifications on all devices required for balancing.
 - d. Note any potential noise problems.
 - 2. Within 90 days of award of contract, meet with the Architect, Mechanical Contractor, and Building Automation System Contractor to review procedures and agenda and comments on design documents as to potential problem areas.
- D. Shop Drawing Review:

TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

1. Review "Instrumentation and Control for HVAC" shop drawing submittals noting any potential balancing problems. Note comments on submittal, sign, stamp and return to General Contractor. All "Instrumentation and Control for HVAC" submittals must be reviewed by balancing agency prior to review by Architect.
- E. Pre-Balancing Conference: Prior to beginning of testing, adjusting, and balancing procedures, schedule and conduct conference with Architect and representatives of installers of mechanical systems. Objective of conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.
- F. During construction, balancing agency shall inspect the installation of pipe systems, temperature controls, and other component parts of plumbing system. Inspections shall be performed periodically as work progresses. Minimum of two inspections are required as follows: (1) when 60 percent of piping is installed; (2) when 90 percent of equipment is installed. Balancing agency shall submit brief written report of each inspection to Owner and Architect.
- G. Standards:
 1. Associated Air Balance Council (AABC) Publication:
 - a. National Standards for Testing and Balancing Heating, Ventilating and Air Conditioning Systems, Latest Edition.
 - b. NSF/ANSI 61 & Annex G: Drinking Water Systems Components – Health Effects.
 - c. NSF/ANSI 372: Drinking Water Systems Components – Lead Content.
 2. American Society of Heating, Refrigeration and air Conditioning Engineers (ASHRAE) Publications:
 - a. "ASHRAE Research Report No. 1162, "Air Flow Measurements at Intake and Discharge Openings and Grilles," ASHVE Transactions, Volume 46.
 - b. ASHRAE Handbook of Fundamentals, Latest Edition.
 3. American National Standards Institute (ANSI) Publications:
 - a. ANSI/AIHA Z9.5 American National Standard for Laboratory Ventilation, Latest Edition.
 4. National Environmental Balancing Bureau (NEBB)
 - a. Procedural Standards for Testing-Balancing- Adjusting of Environmental Systems, Latest Edition.

1.5 OWNER'S INSTRUCTIONS

- A. Balancing contractor's technician along with his balancing engineer shall provide four (4) hours of instruction to Owner's engineers on balancing methods, procedures and equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SYSTEM BALANCE - GENERAL REQUIREMENTS

- A. Balance domestic hot water systems to obtain water quantities indicated and required for proper operation of system.
- B. Field work performed under this Section shall be provided under direct supervision of a Registered Professional Engineer.
- C. Furnish services for complete adjustment of water system distribution and controls.
- D. During all tests, it shall be demonstrated that systems shall be free from leaks and all parts of system will operate correctly. If not, report deficiencies to Contractor and Owner. Balancing Firm shall make final adjustments to system as may be required for proper operation, maintaining correct flow rates in all parts of the building.
- E. Preliminary Work:
 - 1. Inspect project site prior to starting adjustments to verify completion of trades, including general construction, piping system, building automation systems, and electrical systems, as they relate to balancing work. Verification shall include but not be limited to following:
 - a. Piping System (domestic hot water):
 - b. Already cleaned and flushed by mechanical contractor.
 - c. Chemical treatment operating, or applicable to system.
 - d. System filled and vented of air under Division 22.
 - e. Proper direction of rotation for motor-driven equipment and for proper speed on multi-speed motors.
 - f. Balancing devices are installed and accessible.
 - g. Control device connections.
 - h. Note problems in general construction of the building that might effect systems performance such as sealing of windows, building joints, exhaust shafts, etc.
 - i. Problems discovered during this inspection shall be reported to General Contractor and Owner.
 - 2. Contractor shall certify in writing that each piping system has been prepared as per this Section, indicating dates procedures were done and which contractor did work. Submit in writing to Architect before beginning balancing work.
- F. Balancing of domestic hot water circulation systems and parts installed under this Contract to obtain water quantities and temperature drops in all parts of system shown on plans, in specifications on approved shop drawings or as required by Architect.

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3.2 DOMESTIC HOT WATER SYSTEM BALANCE

- A. In conjunction with Instrumentation and Controls System Technician, pumps shall be started per design sequence. With manual valves open, and control valves in normal position, adjust discharge balancing valve to obtain design flow. Compare data with pump submittal curve. If test point falls on curve, proceed with balancing. If recorded data does not fall on pump curve, plot new curve parallel with other curves on chart, from zero to maximum flow. Open discharge balancing valve to full and record discharge pressure, suction pressure and total head. Readjust balancing valve to obtain suction and discharge design flow and pressure, and record data. Check and record pump motor voltage and amperage. Pump motor shall not be overloaded.
- B. With pump system adjusted, perform following tests, compile data and submit report:
1. Pumps:
 - a. Design Data
 - 1) Flow and total dynamic head.
 - 2) Pump speed, and motor output.
 - b. Installed equipment
 - 1) Manufacturer, size and model number.
 - 2) Type drive.
 - 3) Motor rating, voltage, and phase.
 - 4) Full-load amperes.
 - c. Field Test
 - 1) Discharge pressures: Full flow and zero flow.
 - 2) Suction pressures: Full flow and zero flow.
 - 3) Operating flow and total dynamic head
 - 4) No-load amperes (where possible.)
 - 5) Full-flow amperes, zero-flow amperes.
 - 6) Calculated motor output.
- C. With pump system properly adjusted, proceed with following tests adjustments and compilation of data:
1. Pipe Mains and Branches:
 - a. Adjust branch balancing valves to obtain pressure and flowrates required.
 - b. Provide the following:
 - 1) Manufacturer's model number, size of heat exchanger, number of passes.
 - 2) Design and actual flow rate and pressure drop.
 - c. Heat transfer equipment including domestic hot water.
 - 1) Measured Parameters
 - a) Flowrate.
 - b) Heat transfer.
 - c) Entering and leaving temperatures.
 - d) Pressure drops.
 - 2) Equipment data
 - a) Manufacturer and model number.

TESTING, ADJUSTING, AND BALANCING FOR PLUMBING

- b) Motor output horsepower.
- c) Serial numbers.
- 3) Design Data
 - a) Include design data in submittal for comparison.

3.3 CALIBRATION

- A. During testing and balancing, inspect temperature sensors, pressure sensors, digital indicators, and thermometers, etc. provided under Division 22. Report discrepancies to the Contractor for replacement or recalibration.

3.4 RE-BALANCE

- A. After Architect's review of test and balance report submittal, make adjustment in any balancing point as required by Architect, to correct discrepancies between balance report and design, at no additional cost.

3.5 FINAL BALANCE

- A. Visit site within one year after building occupancy if necessary to adjust and rebalance, any system required by Owner, to resolve any and all complaints. After final balance, revise previous submittal and resubmit to architect for record purpose. Rebalance and resubmittals shall be done at no additional cost to Owner.

END OF SECTION

**SECTION 22 07 00
PLUMBING INSULATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the contract, including General and Supplemental Conditions and Division 01 Specifications, apply to this section and the other sections of Division 22.

1.2 SUMMARY

- A. This section Includes:

1. Insulation Materials:
 - a. Cellular glass.
 - b. Flexible elastomeric.
 - c. Glass Mineral Wool
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.
14. Insulation for handicapped fixtures.

- B. Related Sections: The following sections contain requirements that relate to this section.

1. Division 07 Section: "Firestopping:" Product requirements for firestopping for placement by this section.
2. Division 09 Section: "Painting and Coating:" Execution requirements for painting insulation jackets and covering specified by this section.
3. Division 22 Section: "Hangers and Supports for Plumbing Piping and Equipment:" Product and Execution requirements for inserts at hanger locations.
4. Division 22 Section: "Identification for Plumbing Piping and Equipment:" Product requirements for plumbing piping and equipment identification.

1.3 REFERENCES

(Unless otherwise noted, references apply to “latest editions.”)

A. ASTM International:

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
6. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
7. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
8. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
9. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
10. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
11. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
12. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
13. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
14. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
15. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
16. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
17. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
18. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
19. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
20. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
21. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
22. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
23. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
24. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
25. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.

26. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks.
 27. ASTM C1617 – Standard Practice for Quantitative Accelerated Laboratory Evaluation of Extraction Solutions Containing Ions Leached from Thermal Insulation on Aqueous Corrosion of Metals
 28. ASTM C1639 – Standard Specification for Fabrication of Cellular Glass Pipe and Tubing Insulation
 29. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 30. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120.
 31. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 32. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 33. ASTM E2231 – Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics
- B. Underwriters Laboratories Inc.:
1. UL 723 – Standard Test Method for Surface Burning Characteristics of Building Materials
- C. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).
- D. North American Insulation Manufacturers Association (NAIMA).
- E. NAIMA – "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation."
- F. "National Commercial & Industrial Insulation Standards" – MICA Manual.
- G. National Fire Protection Association (NFPA).
- H. Underwriter's Laboratories Environmental (UL Environment).

1.4 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. EPD Submittals: As certified by UL Environment.
- D. Samples: Submit two samples of representative size illustrating each insulation type.
- E. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements

- G. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 QUALITY ASSURANCE

- A. Pipe Insulation shall be UL/ULC Classified per UL 723 or have maximum flame spread index of 25 and maximum smoke developed index of not exceeding 50 in accordance with ASTM E84 using specimen procedures and mounting procedures of ASTM E 2231.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Perform Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.
- E. Fire-Test-Response Characteristics: Insulation and related materials shall be UL/ULC Classified per UL 723 or have fire-test response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Products: Subject to compliance with requirements, provide one of the products specified.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
- F. Insulation materials shall be tested and rated according to ASTM Test Method C-177 to determine k-factors. ASTM C 335 is for pre-formed pipe insulation. Note: C177 is for flat slab materials ONLY; such as board products, etc.
- G. Formaldehyde Free: Third party certified with UL Environment Validation.
- H. Biosoluble: As determined by research conducted by the International Agency for Research on Cancer (IARC) and supported by revised reports from the National Toxicology Program (NTP) and the California Office of Environmental Health Hazard Assessment. Certified by European Certification Board for Mineral Wool Products (EUCB).
- I. Recycled Content: A minimum of 50 percent recycled glass content certified and UL Validated.
- J. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation Products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
- K. Living Building Challenge-Declare Red List Free.
- L. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE,

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Requirements for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping. Remove and replace any wet or damaged unsatisfactory insulation at the architect's direction.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section: "Product Requirements": Environmental conditions affecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature during and after installation for minimum period of 24 hours.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product Warranties and product bonds.
- B. Furnish two-year manufacturer warranty for man-made fiber.

1.12 COORDINATION

- A. Division 01 Section: "Administrative Requirements": Requirements for coordination.
- B. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section: "Hangers and Supports for Plumbing Piping and Equipment."
- C. Coordinate clearance requirements with piping Installer for piping insulation application, and equipment Installer for equipment 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.

1.13 DEFINITIONS

- A. Thermal Conductivity (K value): Units of Btu-inch/hour per square foot per degree F.
- B. UL GREENGUARD: Provides independent third party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product related pollutants. Certification is based upon criteria used by EPA, OSHA, and WHO.
- C. EPA: Environmental Protection Agency.
- D. WHO: World Health Organization.
- E. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with a polypropylene outer film layer leaving no paper exposed.
- F. ASJ: Al-service jacket.
- G. FSK: Foil, scrim, Kraft paper.
- H. FSP: Foil, Scrim, polyethylene.
- I. PVDC: Polyvinylidene chloride.
- J. SSL+: Self-Sealing Lap with Advanced Closure System.
- K. SSL: Self-sealing lap.
- L. ASJ Max: All service jacket composed of aluminum foil with tri-directional reinforcing scrim bonded to Kraft paper with a polypropylene outer layer leaving no exposed paper.
- M. PSK: Poly Scrim Kraft.
- N. PVC: Polyvinyl Chloride.
- O. Glass Mineral Wool: Interchangeable with fiber glass, but replacing the term in the attempt to disassociate and differentiate Glass Mineral Wool from the potential health and safety of special purpose or reinforcement products that do not meet the bio solubility criteria of insulation made

from glass. Rock Mineral Wool will replace the traditional Mineral Wool label. Both are used in lieu of the Mineral Fiber label.

- P. ECOSE® Technology: a revolutionary binder chemistry that enhances the sustainability of products. The "binder" is the bond that holds the Glass Mineral Wool product together and gives the product its shape and brown color. ECOSE Technology is a plant based sustainable chemistry that replaces the phenol/formaldehyde (PF) binder traditionally used in Glass Mineral Wool products. Products using ECOSE Technology are formaldehyde free and have greater reduced global warming potential than compared to products of the past.
- Q. UL GREENGUARD Gold Certification: (formerly known as GREENGUARD Children & Schools Certification) offers stricter certification criteria, considers safety factors to account for sensitive individuals (such as children and the elderly), and ensures that a product is acceptable for use in environments such as schools and healthcare facilities. It is referenced; by both The Collaborative for High Performance Schools (CHPS) and the Leadership in Energy Environmental Design (LEED) Building Rating Systems.
- R. UL Environment Formaldehyde Free Verification Requirements: For a product to be verified as formaldehyde free, product samples must have a measured emission factor of less than or equal to 5 µg/m²h at 24 elapsed hours or 3 µg/m²h at 336 elapsed hours. An emission factor of 5 µg/m²h corresponds to measured chamber concentration of 2.5 µg/m³ for a typical building ratio of 0.5 m²/m³. This chamber concentration is comparable to, or below typical outdoor air concentrations. This demonstrates that the formaldehyde exposure from products labeled as formaldehyde free will not contribute to airborne formaldehyde concentrations at greater levels than those found in the natural outdoor environment.
- S. Declare and The Living Building Challenge – The Living Building Challenge is a philosophy, advocacy tool and certification program that addresses development at all scales. The purpose of The Living Building Challenge is to define the most advanced measure of sustainability in the built environment today and acts to diminish the gap between current limits and ideal solutions. Declare supports The Living Building Challenge by providing a transparent materials database that project teams can select from to meet Imperative 11.
- T. Imperative 11, Red List – requires that manufacturers disclose the ingredients in their products to insure that they are free of Red List chemicals and materials. The Red List represents the “worst in class” materials, chemicals and elements known to pose serious risks to human health and the greater ecosystem.
- U. Underwriters Laboratories Environment (UL Environment): offers independent green claims validation, product assessment and certification. UL GREENGUARD provides third party credibility for sustainable products.
- V. UL Environment Claims Validation (ECV): service and label tests a manufacturer’s product and validates that the environmental claims they make in their marketing and packaging materials are factual. This Environmental Claims Validation (ECV) service will allow manufacturers to verify that their products contain a quantifiable amount of recycled content and, as such, help limit raw material extraction and reduce landfill waste. It also will enable products to qualify for LEED® points under Pilot Credit 43: MR – Certified Products.
- W. EUCEB: exonerated fiber from a health and safety standpoint by the European Certification Board process.

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- X. Recycled Content: materials such as bottled glass collected at curbside or other collection sites after consumer use and/or materials used or created from one manufacturing process which are collected as scrap and placed back into another manufacturing process rather than being placed in a landfill or incinerated.
- Y. Polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants: have been linked to adverse health effects after exposure in low concentrations.
- Z. UL Classified: UL has tested and evaluated samples of the product with respect to certain properties of the product. UL Classifies products to:
 - 1. Applicable UL requirements.
 - 2. Standards for safety.
 - 3. Standards of other National and International organizations.
- AA. EPD: Environmental Product Declaration. A third party verified document that reports environmental data of products based on the Life Cycle Assessment (LCA) and other relevant information, and in accordance with the International Standard ISO 14025 (Type III Environmental Declarations).

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. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 execution: schedule for requirements regarding where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Insulation products shall contain no formaldehyde-based binders or shall be third-party certified for conformance with GREENGUARD Gold or Indoor Advantage Gold. (GREENGUARD Children and Schools is now called GREENGUARD Gold)
- D. When product to be in contact with austenitic stainless steel is tested according to ASTM C795 (which includes ASTM C692 and ASTM C871), the PH of the leach water from the specific material supplied shall be greater than 7.0 but not greater than 11.7 at 77°F (25°C). An acceptable proportion of sodium plus silicate ions to the chloride ions as found by leaching from the insulation is shown in the "plot point" of figure 6 in ASTM C795.

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- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Insulation materials applied to carbon steel shall be Mass Load Corrosion Rate (MLCR) tested per ASTM 1617.
- G. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
 - 1. Products:
 - a. Pittsburgh Corning; FOAMGLAS® ONE™ Insulation.
 - b. Specialty Products & Insulation Company (SPI), Lancaster, PA., Cellular, glass fabricator.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Grade 6.
 - 6. Maximum K-Factor: 0.29 at 75 deg. F. mean temperature.
 - 7. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- H. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products:
 - a. Aeroflex USA Inc.: Aerocel.
 - b. Armacell LLC; AP Armaflex (rectangular)
 - c. Armacell LLC; AP Coilflex (round/oval)
 - d. Nomaco; K-Flex Pipe
 - 2. Water Vapor Permeability: 0.02 perm-inch per ATM E96 Procedure A.
 - 3. Thermal Conductivity: 0.27 at 75 degrees F
 - 4. Warranty: 25 year warranty against breakdown of the membrane due to ultraviolet radiation.
 - 5. Seal Tape: Thermoplastic rubber membrane backed with pressure sensitive adhesive.
- I. Glass Mineral Wool Blanket Insulation: Glass mineral wool bonded with a thermosetting resin. Comply with ASTM C 553, Types I, II and III, ASTM C 1136, Type II and ASTM C 1290, Type I or Type III, UL/ULC Classified per UL 723 or FHC 25/50 per ASTM E 84. UL GREENGUARD Gold Certified and Validated to be formaldehyde free by UL Environment. Product shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE. Factory applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
- J. Glass Mineral Wool Board Insulation: Glass mineral wool bonded with a thermosetting resin. UL/ULC Classified per UL 723 or FHC 25/50. Comply with ASTM C 612, Type IA or Type IB. Living Building Challenge – Declare Red List Free. For equipment applications, provide insulation with factory-applied ASJ+. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

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1. Products:
 - a. Knauf Insulation; Earthwool Insulation Board with ECOSE Technology
 - b. CertainTeed Corp.; Commercial Board.
 - c. Johns Manville; 800 Series Spin-Glas, Type 814.
 - d. Owens Corning; Fiberglas 700 Series.
2. Thermal Conductivity: 0.23 at 75 degrees F

K. Glass Mineral Wool, Preformed Pipe Insulation:

1. Products:
 - a. Johns Manville; Micro-Lok HP Ultra
 - b. Knauf Insulation; Earthwool 1000 Pipe insulation with Ecose® Technology.
 - c. Knauf Insulation; Earthwool Redi-Klad 1000 Pipe insulation with Ecose® Technology. . (for chilled water or outdoor applications)
 - d. Owens Corning; Fiberglas Pipe Insulation SSLII with ASJ Max.
2. Type I, 850 deg F or Type IV, 1000 deg F. Materials: Glass mineral wool bonded with a thermosetting resin. UL/ULC Classified per UL 723 or FHC 25/50 per ASTM E 84. Living Building Challenge – Declare Red List Free for Redi-Klad Pipe or unjacketed Earthwool Pipe only. Comply with ASTM C 585, ASTM C 411, ASTM C 795 and ASTM C 547, Type I and Type IV, with factory-applied ASJ+ - SSL+ or ASJ+ - SSL. Factory-applied jacket requirements are specified in Part 2 “Factory-Applied Jackets” Article.
3. Type II, 1200 degree F Materials: Mineral or glass fibers bonded with thermosetting resin. Comply with ASTM C547, Type II, Grade A, with Factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 “Factory-Applied Jackets” Article.
4. Maximum K-Factor: 0.23 at 75 deg. F mean temperature; 0.34 at 250 deg. F mean temperature.

L. Glass Mineral Wool, Pipe and Tank Insulation: Glass mineral wool bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ Max, ASJ+, or PSK complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Factory-applied jacket requirements are specified in Part 2 “Factory-Applied Jackets” Article.

1. Products:
 - a. Certain Teed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation, with Ecose® Technology - 850°F.
 - d. Knauf Insulation; Kwik Flex Pipe & Tank Insulation -850° F with Ecose ® Technology.
 - e. Owens Corning; Fiberglas® Pipe and Tank Insulation with white ASJ Max for systems operating at temperatures to 650°.
 - f. Owens Corning; Flexwrap for operating temperatures up to 850°
2. Maximum K-Factor: 0.29 at 100 deg F. Mean temperature; 0.45 at 300° F Mean temperature Minimum Density: 2.5 pounds per cubic foot.
3. Minimum Density: 2.5 pounds per cubic foot.

2.3 INSULATING CEMENTS

- A. Comply with VOC limits specified in Section
- B. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- C. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- D. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.4 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Comply with VOC limits specified in Section
- C. Cellular-Glass and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
 - 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 81-84.
 - b. Pittsburgh Corning, PC 99 2k Adhesive.
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I
 - 1. Products:
 - a. Armacell LCC; Armaflex 520 Adhesive, Armaflex 520 BLV Low-VO Adhesive.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-60.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 85-70.
 - b. Eagle Bridges - Marathon Industries, Inc.; 225.
- F. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 85-70.
 - b. Eagle Bridges - Marathon Industries, Inc.; 225.
- G. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:
 - a. Dow Chemical Company (The); 739, Dow Silicone.

2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Comply with VOC limits specified COMAR 26.11.39.05.
- C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - b. Eagle Bridges - Marathon Industries, Inc.; 590.
 - c. Mon-Eco Industries, Inc.; 55-40.
 - d. Vimasco Corporation; 749.
 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - b. Eagle Bridges - Marathon Industries, Inc.; 550.
 - c. Mon-Eco Industries, Inc.; 55-50.
 - d. Pittsburgh Corning, PITTCOTE 404 Coating
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 200 deg F.
 4. Solids Content: 63 percent by volume and 73 percent by weight.
 5. Color: White.

2.6 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. Comply with VOC limits specified in Section
 2. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 81-42W.
 - b. Eagle Bridges - Marathon Industries, Inc.; 130.

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- c. Vimasco Corporation; 713/714.
- 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
- 4. Service Temperature Range: Minus 50 to plus 180 deg F.
- 5. Color: White.

2.7 SEALANTS

- A. Comply with VOC limits specified in Section
- B. Joint Sealants:
 - 1. Joint Sealants for Cellular-Glass and Polyisocyanurate Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - b. Eagle Bridges - Marathon Industries, Inc.; 405.
 - c. Mon-Eco Industries, Inc.; 44-05.
 - d. Pittsburgh Corning Corporation; PITTSEAL® 444Ns Sealant.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Permanently flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 - 5. Color: White or gray.
- C. FSK and Metal Jacket Flashing Sealants:
 - 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - b. Eagle Bridges - Marathon Industries, Inc.; 405.
 - c. Mon-Eco Industries, Inc.; 44-05.
 - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 3. Fire- and water-resistant, flexible, elastomeric sealant.
 - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 5. Color: Aluminum.
- D. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: White.

2.8 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ+ - SSL+; ASJ+ jacket with Self-Sealing Advanced Closure System; complying with ASTM C 1136 Type I, II, III, IV and VII secured with self-sealing longitudinal laps and matching ASJ+ butt strips.

2. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with a polypropylene outer film layer.
3. ASJ Max: All service jacket made using aluminum foil and tri-directional reinforcing scrim bonded to Kraft paper with polypropylene outer layer complying with ASTM C 1136, Type I.
4. Redi-Klad Jacket: Factory applied venture clad 5-ply weather and abuse resistant with self-sealing lap. Zero permeability per ASTM E 96-05; puncture resistance 35.4 kg (189.3_N) per ASTM D 1000; tear strength 4.3lb (19.4_N) per ASTM D 624, thickness 14.5 mils (0.0145"); tensile strength 68 lb/inch width [306 N (32K9)/25mm.]
5. FSK (FRK) Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C 1136, Type II.
6. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
7. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
8. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 - 2) HiCube Coating: HC1000 Vapor Barrier
9. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.
10. PSK Jacket, Polypropylene scrim with Kraft.
11. Aluminum-Polyester Self-Adhesive Jacket: 12 mils (0.22 mm) thick, made with alternating layers of aluminum foil and polyester film coated with cold weather acrylic adhesive. Construction of laminate designed to provide UV resistance, high puncture and tear resistance.
 - a. Products:
 - 1) Armacell LLC; Armatuff
 - 2) Venture Tape; Venture Clad

2.9 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Comply with VOC limits specified in Section
- B. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
 1. Products:
 - a. Vimasco Corporation; Elastafab 894.
- C. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

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- D. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.

1. Products:

- a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
- b. Vimasco Corporation; Elastafab 894.
- c. Pittsburgh Corning Corporation; PC Fabric 79.

2.10 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Comply with VOC limits specified in Section
- C. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with Kraft-paper backing.
- D. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 30 mil thickness; roll stock Ready for shop or field cutting and forming.

1. Products:

- a. Johns Manville; Zeston.
- b. P.I.C. Plastics, Inc.; FG Series.
- c. Proto PVC Corporation; LoSmoke.
- d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: white

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

- a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps and mechanical joints minimum 30 mil thickness.

5. Factory-fabricated tank heads and tank side panels.

6. Provide preformed Fiberglass 1 lb. density 2" thick insulation inserts to comply with ASHRAE 90.1 and ASTM C547 requirements.

E. Metal Jacket:

1. Products:

- a. Childers Products, Division of ITW; Metal Jacketing Systems.
- b. PABCO Metals Corporation; Surefit.
- c. RPR Products, Inc.; Insul-Mate.

2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.

- a. Sheet and roll stock ready for shop or field sizing.

b. Thickness:

- 1) Up to 24 inch diameter, width, or height: 0.016 inch minimum.
- 2) 25 inch to 59 inch diameter, width, or height: 0.024 inch minimum.

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- 3) 60 inch and larger diameter, width, or height: 0.032 inch minimum.
 - c. Finish: Smooth finish.
 - d. Color: White
 - e. Moisture Retarder: 3-mil- thick Polysurlyn (co-extrusion of polyethylene and Dupont Surlyn®, heat laminated to the metal jacketing).
 - f. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and longradius 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.
- 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.
 - 1. Products:
 - a. Polygaurd; Alumaguard 60.
 - b. MFM Building Products Corp., Flex Clad 400.
 - c. Venture Clad Jacketing.
 - d. HiCube Coating Jacketing
- G. 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.
 - 1. Products:
 - a. Pittsburgh Corning Corporation; PITTWRAP® HS Jacketing.
 - b. Polyguard; Insulrap No Torch 125.
- H. Pipe Sound Lagging: Loaded vinyl with fibrous glass scrim reinforced aluminum foil facing over 2-inch thick quilted fiberglass decoupler. Loaded vinyl shall be 2 psf minimum surface weight. Glass fiber pipe wrap shall be semi-rigid, preformed type, 2- inch minimum thickness, 1-1/2 pcf density.
 - 1. Manufacturers:
 - a. Kinetics.
 - b. Sound Seal.
 - 2. Sound Transmission Class (STC) Rating: 26.

2.11 TAPES

- A. Comply with VOC limits specified in Section

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- B. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - e. HiCube Coating: HC108
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- C. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - e. HiCube Coating: HC106
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- D. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 - e. HiCube Coating: HC404
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- E. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.

1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - e. HiCube Coating: HC100
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.
- F. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing, EPA approved anit-microbial additive.
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. Armacell LLC; AP/Armaflex Insulation Tape

2.12 SECUREMENTS

- A. Bands:
1. Products:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- B. Insulation Pins and Hangers:
1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

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- a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106- inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

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- a. Manufacturers:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Insulation Pipe Hanger Supports: Support piping system using high-density inserts with sufficient compressive strength, embedded within flexible elastomeric foam, with thickness equal to or greater than the pipe insulation.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but not limited to, the following
 - 1) Armacell LLC; Armafix IPH
- E. Wire: 0.062-inch soft-annealed, stainless steel.
 - 1. Manufacturers:
 - a. ACS Industries, Inc.
 - b. C & F Wire.
 - c. Childers Products.
 - d. PABCO Metals Corporation.
 - e. RPR Products, Inc.

2.13 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

2.14 HANDICAPPED WHEEL/CHAIR PLUMBING FIXTURE PIPING INSULATION

- A. Manufacturer:
 - 1. TRUEBRO, INC. or comparable acceptable product.
- B. Product:
 - 1. ADA-conforming, wheelchair accessible lavatory P-trap and angle valve assemblies shall be covered with white, molded, antimicrobial TRUEBRO, INC. Lav Guard 2 under sink pipe covers. Cover shall have internal, E-Z Tear-To-Fit trim feature for square, clean trimming-internal ribs-and built-in, concealed E-Z Grip fasteners (no cable-tie fasteners allowed.)
- C. Undersink Protection Systems
 - 1. Provide Lav Shield® ADA-compliant under sink protection to meet requirements for wheelchair accessibility. Single-piece construction shall conceal piping, electronic faucet

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connections, mixing valves, trap primers and instantaneous hot water heaters. (Lavatory "rough in" shall be considered to allow mounting room for water heater-contact vendor for specifications.) Pre-cut Lav Shield shall be cut to fit various lavatory models.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Execution and Closeout Requirements." Coordination and project conditions.
- B. Verify piping and equipment to be insulated has been tested before applying insulation materials.
- C. Verify surfaces to be insulated are clean and dry, with foreign material removed.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade 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 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Install insulation continuously through hangers and around anchor attachments.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at anchors and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with self-sealing factory-applied jackets as follows:
 - 1. Locate all longitudinal pipe insulation jacketing laps in least visible location.
 - 2. Draw jacket tight and smooth.
 - 3. For proper sealing, seal lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool.
 - 4. Vapor seal all circumferential joints with factory furnished matching pressure sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool
- N. Install insulation with non-self-sealing 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 selfsealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- O. Cut and install insulation in a manner to avoid compressing insulation more than 25 percent of its original nominal thickness.

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- P. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- Q. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- R. Replace insulation on existing piping, and equipment where indicated on the drawings. Match insulation type and thickness indicated by the insulation schedule at the end of this section.
- S. Replace insulation on new and existing piping, and equipment where insulation is damaged during construction or removed for testing and balancing work.
- T. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.
 - 7. Unions.
 - 8. Flanges.

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 Below-Grade 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.

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4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
- F. Insulation Installation at Floor Penetrations:
 1. Install insulation continuously through floor penetrations.

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Secure insulation with anchor pins and speed washers. Insulation for tanks and vessels should only be applied using weld pins or self-adhesive pins (depending on the circumstances) and speed washers. Adhesive should not be used to secure insulation to the tanks or vessels except when utilizing flexible elastomeric insulation.
 1. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 2. Protect exposed corners with secured corner angles.
 3. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 5. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
 6. Stagger joints between insulation layers at least 3 inches.

7. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
8. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
9. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. PIPE & TANK INSULATION AND KWIKFLEX

1. Apply on clean, dry surfaces
2. Cut to appropriate length using manufacturers' stretch out guide for the specific pipe size. Add an additional 2 inches to 4 inches for staple flap.
3. Install insulation around the equipment and pipe circumference in a manner that ensures a firm fiber mesh at all joints. Fasten the longitudinal with outward clinches staples placed 3 inches on center. As an alternative, individual sections may be fastened in lace using continuous and overlapping strands of $\frac{3}{4}$ " wide glass fiber filament tape around the insulation jacketing O.D. Longitudinal and circumferential joints shall be sealed with 4" wide matching pressure sensitive tape squeegeed along the entire length.
4. For equipment and pipe exposed to the elements, jacketing shall be or 0.016 inches thick aluminum with factory applied moisture barrier 0.010 inches thick stainless steel with a factory applied moisture barrier or laminated self-adhesive water and weather seals. Fitting covers shall be similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2" overlap joint. For systems operating below ambient, all joints shall be sealed completely along the longitudinal and circumferential seams and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2" wide or a minimum 2" overlap. Butt strips shall overlap the adjacent jacketing a minimum $\frac{1}{2}$ inch and be completely weather sealed. For systems operating above ambient, circumferential joints should overlap a minimum of 2" and not be sealed. Insulation thickness for duct covered by Jacketing shall be such that the surface temperature of the does not exceed 125°F.
5. On below ambient straight duct, vapor retarder mastic shall be applied to raw glass fiber ends at 12 foot to 21 foot intervals, and on either side of fittings, flanges or valves before taping. Mastic shall extend a minimum of 2 inches onto the bore of the pipe and 2 inches onto the jacketing.

C. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

D. Insulation Installation on Pumps:

1. Fabricate removable, re-useable metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Covers for split case pumps shall be constructed with insulated housing in two sections with upper section removable for access to casing. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install $\frac{3}{8}$ -inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum or stainless steel, at least 0.050 inch thick.

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3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Fittings shall be insulated to same thickness as the adjoining insulation. Apply fittings per fitting manufacturer's instructions. When required by specification, a hard insert of sufficient length shall be utilized to avoid compression of the insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 GLASS MINERAL WOOL INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes.
1. Secure pipe insulation to pipe using self-sealing lap system.
 2. On high temperature piping, above 500°F, apply insulation using double layer and staggered joints. For double layer installation, secure theunjacketed inner layer using filament tape; without deforming insulation material. All joints and ends must be firmly butted and secured with appropriate securing material.
 3. Firmly rub all longitudinal and circumferential joints using a squeegee or sealing tool.
 4. Longitudinal jacket laps for pipe insulation installed on piping systems with operating temperatures below ambient shall be vapor sealed with factory-applied pressure-sensitive adhesive vapor retarder, self-sealing lap. For proper sealing, firmly rub lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool. Vapor seal all circumferential joints with factory-furnished, matching pressure-sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool. Additionally, coat raw edges of pipe insulation sections with vapor retarder mastic at 12 foot to 21 foot intervals, and on either side of all fittings, flanges, or valves. Vapor retarder mastic shall completely coat the ends of the pipe and extend onto the bore of the pipe insulation and onto the jacketing a minimum of 2 inches. Follow NAIMA's "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation" for additional details.
 5. Install metal shields between hangers or supports and the pipe insulation. Install rigid insulation inserts as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required. Insulation shields shall be no less than the following lengths:
 - a. 1 – 1/2 inch to 2- 1/2 inch IPS: 10 inch long.
 - b. 3 inch to 6 inch IPS: 12 inch long
 - c. 8 inch to 10 inch IPS: 16 inch long

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- d. 12 inch and over IPS: 22 inch
 6. For piping subject to abuse in mechanical rooms or high traffic areas, protect insulation from mechanical abuse by the use of appropriate thickness of PVC jacketing, metal jacketing, or laminated self-adhesive water and weather seal.
 7. For piping exposed to the elements, install Redi-Klad Insulation with 4 inch butt stripes and self-sealing lap, a jacket that shall be a minimum of 0.016 inch thick aluminum jacket with factory-applied moisture barrier or a minimum 0.010 inch thick stainless steel jacket with factory-applied moisture barrier. Fittings shall be of similar materials. Apply all jacketing per manufacturer's recommendations for the conditions.
 8. For piping operating below ambient temperature or in high abuse areas, install Redi-Klad Pipe Insulation with 4 inch butt strips and self-sealing lap. Follow the same guide lines with using Redi0Klad as indicated for ASJ+-SSL+above.
- B. Insulation installation for 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 Glass Mineral Wool 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 formaldehyde free Glass Mineral Wool fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed formaldehyde free fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.8 CELLULAR-GLASS INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with tape 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 below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellularglass block insulation of same thickness as 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 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 tape 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.

3.9 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.10 ROCK MINERAL WOOL INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials, unless jacketing with self-sealing laps are used.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.11 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; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
 1. Where rubber membrane jackets are indicated, install the membrane using the manufacturer's recommended adhesive. Before use thoroughly stir the adhesive. Replace the container lid when work is interrupted. If required thin the adhesive as recommended by the manufacturer.
 2. Using a sheepskin or similar roller apply a primer coat of adhesive to the roof surface, priming only the area of roof where the membrane will be laid the same day. Allow adhesive to dry.
 3. Unroll the membrane and fold back approximately half its length.
 4. Apply adhesive with a sheepskin or similar roller to the underside of the membrane ensuring the weld area is kept free of adhesive and allow to touch dry.
 5. Carefully roll out the membrane over the previously primed surface and roll with water filled roller.
 6. Fold back other half of the roll of membrane and repeat the procedure.
 7. Unroll the next roll of membrane, ensuring the end laps are staggered and the side overlaps the previously installed sheet by 2 inches.
 8. Repeat the adhering process.

9. Fully hot air weld the 2-inch side lap, allow to cool completely.
10. Mechanically check the integrity of the cooled weld by running a 3/16-inch wide screwdriver (with rounded edges) along the seam applying pressure into the seam.
11. Install Peel Stop and PVC Welding Cord at all perimeters, penetrations and changes of roof direction.

E. Pipe Sound Lagging:

1. Seal and fasten in accordance with manufacturer's written instructions to maintain specified STC rating.
2. Cover entire pipe with glass fiber wrap. Fill all voids with clean glass fiber scrap. Apply over this wrap an airtight cover of loaded vinyl. Do not connect the cover rigidly to pipe or hangers. Overlap longitudinal seams in loaded vinyl 2-inch minimum and tape with cloth-backed tape. Overlap edge seams 1-inch minimum and tape with cloth-backed tape or with acoustical sealant. Extend ends of cover within 1/2-inch of penetration through wall, ceiling, and/or floor. Seal annular gap between pipe lagging and penetration airtight with acoustic sealant.

3.12 FINISHES

- A. Finish Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Refer to Division 09 painting Sections.
- 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.
- E. Clad-type weather-resistant jacket such as Venture clad may be used to finish plumbing equipment exposed to weather.
- F. Piping exposed to weather Knauf Earthwool Redi-Klad 1000 Pipe Insulation with Ecose® Technology may be utilized as long as it is installed per the manufacturer's installation procedures.

3.13 INSULATION APPLICATION SCHEDULE

- A. Acceptable insulation materials, thickness and vapor retarder requirements are identified for each application and size range. If more than one material is listed for an application and size range, selection from the materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 1. Fire-suppression piping.
 2. Drainage piping located in crawl spaces.
 3. Below-grade piping.
 4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

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5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.14 PLUMBING PIPING INSULATION APPLICATION SCHEDULE:

- A. Unconditioned spaces include locations where summer temperature and humidity conditions are similar to outdoor conditions (such as mechanical rooms ventilated with unconditioned outdoor air, parking garages, pedestrian tunnels, etc.) Pipes in these spaces to be insulated similar to outdoor requirements.
- B. Where rigid pipe insulation (cellular glass, etc.) is scheduled, provide mineral fiber through and 6 inches beyond pipe sleeves, to allow for pipe expansion.

SERVICE	INSULATION MATERIAL	VAPOR RETARDER REQUIRED	PIPE SIZE	INSULATION THICKNESS REQUIRED
Domestic cold water, potable and non-potable (Indoor)	Glass Mineral Wool	Yes	<8"	1"
Domestic hot water and hot water recirculating, potable and non-potable (Indoor)	Glass Mineral Wool	No	<1.5"	1"
			≥ 1.5"	1.5"
Air conditioning condensate drain, equipment drain, and non-steam humidifier drain	Flexible Elastomeric	No	<1"	0.5"
			1" to <8"	1"
			≥ 8"	1.5"
Exposed sanitary drains and domestic water supplies and stops for fixtures	TruBro LAV-guard-2	Yes	All	Per Specification
Exposed piping, electronic faucet connections, mixing valves, trap primers and hot water heaters	Truebro Lav Shield	Yes	All	Per Specification

3.15 PLUMBING EQUIPMENT INSULATION APPLICATION SCHEDULE

SERVICE	INSULATION MATERIAL	INSULATION THICKNESS	VAPOR RETARDER REQUIRED
DOMESTIC HOT WATER PUMP	Glass Mineral Wool	1"	No

EXPANSION / COMPRESSION TANKS AND HYDROPNEUMATIC TANKS (FOR DOMESTIC WATER, AND DOMESTIC CHILLED / POTABLE WATER DUTY	Flexible Elastomeric	1"	No
DOMESTIC HOT WATER STORAGE TANKS	Glass Mineral Wool Board; or Glass Mineral Wool Pipe and Tank	4"	No

3.16 FIELD APPLIED JACKET APPLICATION SCHEDULE

SERVICE	FIELD APPLIED JACKET TYPE
Indoor, exposed insulated piping within 12 feet of floor, for service temperatures 200 degrees F and below.	PVC or Earthwool Redi-Klad
Indoor concealed piping	None
Indoor, All Locations, Fittings and valves in piping systems at service temperatures 200 degrees F and below.	Factory Fabricated PVC covers
Outdoor underground insulated piping	Underground Direct Buried Jacket
Equipment, generally (Refer to Notes 1 & 2)	Woven Glass Fiber Fabric

A. Jacket Application Schedule Notes:

1. Refer to Part 3 specification section titled "Equipment, Tank, and Vessel Insulation Installation" for requirements for removable, re-usable metal boxes lined with insulation at pumps.
2. Including factory insulated equipment without factory applied jacket.
3. If ductwork or piping indicated to have sound lagging also requires an additional field jacket, install sound lagging between insulation and additional field jacket.

END OF SECTION

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PLUMBING PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specifications, apply to this section, and the other sections of Division 22.

1.2 SUMMARY

- A. Section includes:
 - 1. Domestic water cartridge circulator pumps.
 - 2. In-line domestic hot water circulation pumps (ECM motor).
 - 3. Air conditioning condensate pumps (non-plenum rated).
 - 4. Air conditioning condensate pumps (plenum rated).
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 22 Section: "Common Motor Requirements": Product requirements for motors for placement by this section.
 - 2. Division 22 Section: "Vibration and Seismic Controls for Plumbing Piping and Equipment": Product requirements for vibrations isolators installed with pumps.
 - 3. Division 22 Section: "Pipes and Tubes for Plumbing Piping and Equipment": Execution requirements for connection to pumps specified by this section.
 - 4. Division 22 Section: "General-Duty Valves for Plumbing Piping": Product requirements for valves used in hydronic piping systems.
 - 5. Division 26 Section: "Low Voltage Electrical Power Conductors & Cables": Requirements for electrical wiring and cable connections to pumps specified by this section.
 - 6. Division 26 Section: "Raceways and Boxes for Electrical Systems:" Requirements of conduits and boxes housing electrical wiring and electric connections for pumps specified in this section."

1.3 REFERENCES

("Unless otherwise noted, references apply to "latest" "editions")

- A. National Electrical Manufacturers Association:
 - 1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).
- B. Underwriters Laboratories, Inc.:

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1. UL 778 – Motor Operated Water Pumps.

C. American National Standards Institute:

1. NSF/ANSI 372 – Drinking Water Systems Components – Lead Content.
2. NSF/ANSI 61 & Annex G – Drinking Water Systems Components - Health Effects.

D. American Society of Heating, Refrigeration and air Conditioning Engineers:

1. ASHRAE 90.1 – 2010 – Energy Standard for Buildings, Except Low-Rise Residential Buildings.

1.4 DEFINITIONS

A. Lead Free:

1. Circulator pumps shall be “lead free”, containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
2. The pipes, pipe fittings, plumbing fittings or fixtures in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooking, shall be “lead free”, containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
3. Solder and flux for soldered joints in potable water piping shall be “lead free”, containing not more than 0.2% lead free.

1.5 SUBMITTALS

- A. Division 01 Section – “Submittal Procedures”: Requirements for submittals.
- B. Product Data: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes, and finishes.
- C. Plumbing drainage specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
- D. Plumbing supply specialties: Submit manufacturers catalog information with sizes, capacities, rough-in requirements, service sizes, and finishes.
- E. Pumps: Include capacities, pump curves, equipment performance, and electrical characteristics.
- F. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

- H. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 Section – “Execution and Closeout Requirements”: Requirements for Submittals.
- B. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with all applicable codes, standards, and local authorities having jurisdiction requirements.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products in this section with minimum three years documented experience.
 - 1. Manufacturer shall be listed by UL as a manufacturer of packaged pumping systems under UL/CUL category QCZJ and pump package shall bear labeling noting this.
- B. Installer: Company specializing in performing work of this section with minimum three years experience and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section – “Product Requirements”: Requirements for transporting, handling, storing and protecting products.
- B. Prepare pumps and accessories for shipment to prevent entry of foreign matter into product body.
- C. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on the ground; handle products to prevent damage to interior or exterior surfaces.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 Section – “Execution and Closeout Requirements”: Product warranties.

- B. Furnish five year manufacturer's warranty for pumps.

1.12 DEFINITIONS

- A. Lead Free:
1. The pipes, pipe fittings, plumbing fittings or fixtures in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooking, shall be "lead free", containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
 2. Solder and flux for soldered joints in potable water piping shall be "lead free", containing not more than 0.2% lead free.

PART 2 - PRODUCTS

2.1 AIR CONDITIONING CONDENSATE PUMP (NON-PLENUM RATED)

- A. Manufacturer:
1. Pumps shall meet model numbers, types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule Drawings. Acceptable manufacturers: Little Giant, Bell & Gossett or Hartell.
- B. Unit shall come with vertical type pump unit.
- C. Motor shall come with stainless steel shaft, and thermal overload protection.
- D. Pump shall be UL listed.
- E. Unit shall come with:
1. ABS housing, ABS cover, and ABS volute.
 2. Leakproof, rust proof, ABS tank, with mounting tabs.
 3. 3/8" O.D. barbed discharge adapter.
 4. 3 drain holes.
 5. Built-in check valve.
 6. 6' long power chord.
 7. 20' shut-off head.
- F. Provide unit with optional safety switch.
- G. Impeller shall be glass filled polypropylene.
- H. Pump shall be suitable for intermittent liquid temperatures up to 120°F and for high-efficiency gas furnace condensate as well as standard HVAC unit condensate.

2.2 SUBMERSIBLE SUMP PUMP

A. Manufacturer:

1. Pumps shall meet model numbers, types, sizes, capacities, and characteristics as scheduled on the Equipment Schedule Drawings. Acceptable manufacturers:
 - a. Liberty Pumps (BOD)
 - b. Little Giant
 - c. Zoeller

B. The submersible pump shall be capable of handling effluent with 3/4" solid handling capability. The submersible pump shall have a shut- off head of 37 feet and a maximum flow of 62 GPM @ 5 feet of total dynamic head.

C. Pump shall be controlled by integrally wired on/off float switch.

D. Construction:

1. Each submersible pump shall be equal to the UL certified Series 280 SERIES pumps as manufactured by Liberty Pumps, Bergen NY.
2. The castings shall be constructed of class 25 cast iron.
3. The motor housing shall be oil filled to dissipate heat. Air filled motors shall not be considered equal since they do not properly dissipate heat from the motor.
4. All mating parts shall be machined and sealed with a Buna-N o-ring.
5. All fasteners exposed to the liquid shall be stainless steel.
6. The motor shall be protected on the top side with sealed cord entry plate with molded pins to conduct electricity eliminating the ability of water to enter internally through the cord. The motor shall be protected on the lower side with a unitized ceramic/carbon seal with stainless steel housings and spring.
7. The pump shall be furnished with stainless steel handle.

E. Electrical:

1. The submersible pump shall be supplied with 10, 25, 35, or 50 feet of multiconductor power cord.
2. It shall be cord type SJTW, or SJTOOW capable of continued exposure to the pumped liquid. The power cord shall be sized for the rated full load amps of the pump in accordance with the National Electric Code.
3. The power cable shall not enter the motor housing directly but will conduct electricity to the motor by means of a watertight compression fitting cord plate assembly, with molded pins to conduct electricity. This will eliminate the ability of water to enter internally through the cord, by means of a damaged or wicking cord.

F. Bearings and Shaft:

1. An upper and lower ball bearing shall be required. The ball bearing shall be a single ball / race type bearing. Both bearings shall be permanently lubricated by the oil, which fills the motor housing. The motor shaft shall be made of 300 or 400 series stainless steel and have a minimum diameter of .311"

G. Seals:

1. The pump shall have a unitized carbon / ceramic seal with stainless steel housings and spring equal to Crane Type 6A. The motor plate / housing interface shall be sealed with a Buna-N o-ring.

H. Impeller

1. The impeller shall be vortex style made of an engineered polymer, with pump out vanes on the back shroud to keep debris away from the seal area. It shall be threaded to the motor shaft.

I. The exterior of the casting shall be protected with powder coat paint.

J. The pump shall have a ground continuity check and the motor chamber shall be Hi-potted to test for electrical integrity, moisture content and insulation defects. The motor and volute housing shall be pressurized, and an air leak decay test is performed to ensure integrity of the motor housing. The pump shall be run, voltage and current monitored, and the tester checks for noise or other malfunction.

K. The pump shall be manufactured in an ISO 9001 certified Facility.

L. Standard limited warranty shall be 3 years.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section – “Administrative Requirements”: Verification of existing conditions before starting work.
- B. Verify excavations are to required grade, dry, and not over-excavated.

3.2 INSTALLATION - PUMPS

- A. Install line size valving as indicated on the contract drawings on pump suction and discharges.
- B. Install pumps with shaft length allowing sump pumps to be located minimum 24 inches (600 mm) below lowest invert into sump pit and minimum 6 inches (150) clearance from bottom of sump pit.
- C. Lubricate pumps before start-up.
- D. All power and control wiring shall be performed per manufacturer's instructions and applicable codes, standards and the authority having jurisdiction.
- E. Install flexible connectors at or near pumps where piping configuration does not absorb vibration. Refer to Division 22 Section “Vibration and Seismic Controls for Plumbing Piping and Equipment”.

PLUMBING PUMPS

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F. Third Party Testing, NSF, and OSHA Requirement:

1. The package shall be UL Listed as a system for its intended use, a NSF 61 approved system per NSF 61 guidelines so meeting OSHA Federal Regulations 29 CFR 1910.303 and 399 as well as NFPA Pamphlet #70 (National Electric Code) Article 90-7, City of Los Angeles Approval Code, CMR248 Massachusetts State Plumbing Code Approval.

G. Factory Test:

1. The package shall be electrically and hydrostatically tested before shipment, in addition, each system shall be factory tested from 0-100% of flow and pressure. Provide certified x-y test report.

H. Startup:

1. The factory authorized local representative shall provide (2) hours of startup and field training.

END OF SECTION

SECTION 22 25 01

PLUMBING PIPING SYSTEMS CLEANING AND TREATMENT

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. Potable Water Systems
- 2. Gravity Drains

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

- 1. Division 23: "Common Motor Requirements": Product requirements for motors for placement by this section.
- 2. Division 26: "Wiring Devices": Execution requirements for electrical connection specified by this section.

1.3 DEFINITIONS

- A. Gas Distribution Piping: Piping which conveys gas from the point of delivery to the points of usage.
- B. Point of Delivery is the outlet of the service meter assembly, or the outlet of the service regular (service shutoff valve when no meter is provided).
- C. Domestic Water Systems: A system conveying domestic potable or non-potable water, such as Cold Water, Hot Water, Hot Water circulating, etc.
- D. Gravity Drainage Systems: A system of gravity fed effluent conveying storm water, sanitary, and laboratory acid waste, etc.

1.4 REFERENCES

- A. Unless otherwise noted, references included throughout this specification section apply to "Latest Edition".

1.5 SUBMITTALS

PLUMBING PIPING SYSTEMS CLEANING AND TREATMENT

- A. Division 01 Section – “Submittal Procedures”: Submittal Procedures.
- B. Product data for each type of product specified. Include manufacturer's technical product data, rated capacities of selected equipment clearly indicated, water-pressure drops, weights (shipping, installed, and operating), furnished specialties, accessories, and installation and startup instructions. Provide a list of all chemicals and quantities, including material safety data sheets.
- C. Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, loadings, required clearances, method of field assembly, components, and location and size of each field connection.
- D. System diagram showing all piping, valving, tubing, treatment equipment, etc.
- E. Wiring diagrams detailing power and control wiring and differentiating clearly between manufacturer-installed wiring and field-installed wiring.
- F. Field test reports indicating and interpreting test results relative to compliance with specified requirements.
- G. Maintenance data for chemical water treatment to include in the operation and maintenance manual specified in Division 01. Include detailed manufacturer's instructions and parts list for each item of equipment, control, and accessory. Include troubleshooting maintenance guide.
- H. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 QUALITY ASSURANCE

- A. Qualifications: A recognized chemical water treatment supplier with documented experience. The supplier shall employ an experienced consultant, available at reasonable times during the course of the Work to consult with Contractor, Architect, and Owner about water treatment.
 - 1. Provide a list of at least five (5) projects of similar size and type, which have been in operation for at least 5 years.
 - 2. Supplier shall provide 24-hour emergency service, and shall be capable of being on-site within 4 hours notice.
- B. Chemical Standards: Meet state and local pollution-control regulations.
- C. Comply with NFPA 70, “National Electrical Code,” for components and installation.
- D. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- E. Provide cleaning of the piping systems and submit a certificate of compliance with the specification.

1.7 MAINTENANCE

- A. Extra Materials
 - 1. Furnish the following extra materials, matching products installed, packaged with protective covering for storage and with identification labels clearly describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Chemical Water Treatment Products:
 - a. Arc Water Treatment Co.
 - b. Aqua-Chem, Inc.
 - c. Ecolab.
 - d. Nalco Chemical Co.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install treatment equipment level and plumb, according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- B. Connections
 - 1. Piping installation requirements are specified in other Division 22 Sections. The Drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:
 - a. Install piping adjacent to equipment to allow servicing and maintenance.
 - b. Piping: Conform to applicable requirements of Division 22 Section: "Pipes and Tubes for Plumbing Piping and Equipment."
 - 2. Electrical: Conform to applicable requirements of Division 26 Sections for connecting electrical equipment.
 - a. Install electrical devices furnished with boiler but not specified to be factory mounted.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Provide the services of a qualified independent testing agency to perform field quality control testing.

3.3 STERILIZATION OF DOMESTIC WATER SYSTEMS

A. Sterilization:

1. After final testing for leaks, all new potable water lines shall be thoroughly flushed by plumbing contractor to remove foreign material. Before placing the systems in service, contractor shall engage a qualified service organization, Arc Water Treatment Company of Maryland, Inc. or approved equal, to sterilize the new water lines in accordance with the following procedure:
 - a. Through a $\frac{3}{4}$ " hose connection in the main entering the building pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 200 ppm. Plumbing contractor shall provide plumbing connections and power for pumping chlorine into the system.
2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident.
3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 ppm chlorine, retain this water in the system for three (3) hours. CAUTION: Over-concentration of chlorine and more than three (3) hours of retention may result in damage to piping system. It is not necessary to retain chlorine in any system for twenty-four hours to achieve sterilization. AWWA states that 200 ppm chlorine for three hours is sufficient.
4. At the end of the retention period, no less than 100 ppm of chlorine shall be present at the extreme end of the system.
5. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 ppm.
6. Obtain representative water sample from the system for analysis by a recognized bacteriological laboratory.
7. If the sample tested for coliform organism is negative, a letter and laboratory report shall be submitted by the service organization to the contractor, certifying successful completion of the sterilization.
8. If any samples tested indicate the presence of coliform organisms, the entire sterilization procedure shall be repeated.

3.4 SYSTEM START-UP

- A. Startup Services: Provide the services of a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Startup Procedures: During boiler system startup, operate boiler water treatment system (after charging with specified chemicals) to maintain required steady-state characteristics of feedwater.

3.5 DEMONSTRATION

- A. Division 01 Section – “Execution and Closeout Requirements”: Requirements for demonstration and training.
- B. Provide services of supplier's technical representative for half a day to instruct Owner's personnel in operation, maintenance, and testing procedures of boiler water treatment system.
- C. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- D. Review data in the operation and maintenance manuals Division 01. Refer to Division 01 Section: "Execution and Closeout Requirements."
- E. Schedule training with Owner, through the Architect, with at least 7 days' advance notice.

3.6 SIX MONTH FOLLOW-UP SERVICE

- A. The contractor shall return to the project site under warranty phase in six months to flush / blow down all: Domestic Water strainers.

END OF SECTION

SECTION 22 33 00

ELECTRIC DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the contract, including General and Supplementary Conditions and Division 01 specification sections, apply to this section and all sections of Division 22.

1.2 SUMMARY

- A. Section includes:
 - 1. Commercial electric water heaters.
- B. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 03 Section – “Cast-in-Place Concrete”: Execution requirements for concrete housekeeping pads specified by this section.
 - 2. Division 22 Section: “Plumbing Insulation” for applied insulation for domestic water heaters.
 - 3. Division 22 Section: “Pipes and Tubes for Plumbing Piping and Equipment” connections to domestic water heaters.
 - 4. Division 22 Section: “General Duty Valves for Plumbing Piping”
 - 5. Division 26 Section: “Low Voltage Electric Conductors and Power Cables:” Requirements for electric wiring and cable connections for water heaters specified in this section.
 - 6. Division 26 Section: “Raceways and Boxes for Electrical Systems:” Requirements for conduits and boxes housing electrical wiring and connections specified in this section.”

1.3 REFERENCES

(Unless otherwise noted, references apply to “latest edition.”)

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- B. American Society of Mechanical Engineers:
 - 1. ASME PTC 25 - Pressure Relief Devices.
 - 2. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

ELECTRIC DOMESTIC WATER HEATERS

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C. American National Standards Institute:

1. NSF/ANSI 61 & Annex G: Drinking Water Systems Components – Health Effects.
2. NSF/ANSI 372: Drinking Water Systems Components – Lead Content.

1.4 SUBMITTALS

- A. Division 01 Section – “Submittal Procedures”: Submittal Procedures.
- B. Shop Drawings: Indicate water heater(s) dimensions, size of taps, and performance data. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, taps, and drains.
- C. Product Data: Submit dimensioned drawings of water heaters indicating components and connections to other equipment and piping. Submit electrical characteristics and connection locations.
- D. Manufacturer's Installation Instructions: Submit mounting and support requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 Section – “Execution and Closeout Requirements”: Closeout procedures.
- B. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.6 QUALITY ASSURANCE

- A. Conform to ASME Section VIII for construction of water heaters. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.
- B. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1.
- C. Perform work in accordance with all applicable codes, standards and local authorities jurisdiction requirements.
- D. Lead Free:
 1. The pipes, pipe fittings, plumbing fittings or fixtures in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooking, shall be “lead free”, containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.

- E. Solder and flux for soldered joints in potable water piping shall be "lead free", containing not more than 0.2% lead.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience and approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section – "Product Requirements": Product storage and handling requirements.
- B. Accept water heaters on site in original labeled cartons. Inspect for damage.
- C. Protect tanks with temporary inlet and outlet caps. Maintain caps in place until installation.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 Section – "Execution and Closeout Requirements": Product warranties and bonds.
- B. Furnish five year manufacturer warranty for domestic water heaters and water storage tanks.

PART 2 - PRODUCTS

2.1 Residential Electric water heater (WH-1, 2, 3)

- A. This water heater shall be A. O. Smith Model ENT electric heater, or an approved equal.
- B. Water heater shall achieve a minimum energy factor of 0.92.

- C. Heater shall be rated at 4.5 kW, 240 Volts and listed by Underwriters' Laboratories.
- D. Heater shall have a maximum working pressure of 150 psi, a nominal storage tank capacity listed on water heater schedule, with a separate 3/4" tapping for relief valve installation.
- E. Unit shall include a rigidly supported anode rod for maximum cathodic protection.
- F. All internal surfaces of the heater exposed to water shall be coated with a glass lining composition that is fused to the tank steel. Electric heating elements shall be screw-in design. Element operation shall be double element, non-simultaneous (unless ordered differently).
- G. The controls shall include a thermostat with each element and a high temperature cutoff. The jacket shall provide full size control compartments for performance of service and maintenance through front panel openings and enclose the tank with foam insulation.
- H. The drain valve shall be located in the front for ease of service.
- I. Outer jacket shall be an enamel type finish.
- J. Fully illustrated instruction manual to be included.
- K. Code Compliance: Complies with the Federal Energy Conservation Standards effective April 16, 2015, in accordance with the Energy Policy and Conservation Act (EPCA), as amended. Meets the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRE/IESNA 90.1 and editions of UBC, CEC and HUD National Codes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Maintain manufacturer's recommended clearances around and over water heaters.
- B. Install water heaters on 4" high concrete housekeeping pads, dimensions per contract drawings. Refer to Division 03 Section: "Cast-In-Place Concrete".
- C. Connect domestic hot water and domestic cold water piping to supply and return water heater connections.
- D. Install valves and piping accessories in accordance with details as indicated on the contract documents. Refer to Division 22 Section: "Pipes and Tubes for Plumbing Piping and Equipment" and to Division 22 Section: "General Duty Valves for Plumbing Piping and Equipment".
- E. Install discharge piping from relief valves and drain valves to nearest floor drain.
- F. Install water heater trim and accessories furnished loose for field mounting.

ELECTRIC DOMESTIC WATER HEATERS

- G. Install electrical devices furnished loose for field mounting.
- H. Install control wiring between water heater control panel and field mounted control devices.
- I. Install Work in accordance with all applicable codes, standards, and local authorities having jurisdiction requirements.
- J. Provide die-electric connections when dissimilar metals are present.

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section, and the other sections of Division 22.

1.2 SUMMARY

- A. Section Includes:
1. Water closets.
 2. Lavatories.
 3. Counter Top Sink.
 4. Kitchen Sinks.
 5. Mop Sink / Service Sinks.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
1. Division 22 Section: "Common Work Results for Plumbing."
 2. Division 22 Section: "Pipes and Tubes for Plumbing Piping and Equipment": Supply connections to plumbing fixtures.
 3. Division 26 Section: "Low Voltage Electric Power Conductors and Cables": Requirements for electrical wiring and cable connections for sensor valves and faucets specified in this section.
 4. Division 26 Section: "Raceways and Boxes for Electrical Systems:" Requirements for conduits and boxes housing electrical wiring and connections for items specified in this section."

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. American National Standards Institute:
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 2. ANSI Z124.1 - Plastic Bathtub Units.
 3. ANSI Z124.2 - Plastic Shower Units.
 4. ANSI Z358.1 - Emergency Eyewash and Shower Equipment.
 5. NSF/ANSI 61 & Annex G: Drinking Water Systems Components – Health Effects.

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6. NSF/ANSI 372: Drinking Water Systems Components – Lead Content.
- B. Air-Conditioning and Refrigeration Institute:
 1. ARI 1010 - Self-Contained, Mechanically Refrigerated Drinking-Water Coolers.
- C. American Society of Mechanical Engineers:
 1. ASME A112.6.1 - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use.
 2. ASME A112.18.1 - Plumbing Fixture Fittings.
 3. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
 4. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
 5. ASME A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).
 6. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.
 7. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals.
- D. Drinking Water System Components – Lead Content:
 1. NSF/ANSI 372

1.4 DEFINITIONS

- A. Lead Free:
 1. The pipes, pipe fittings, plumbing fittings or fixtures in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooking, shall be “lead free”, containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
 2. Solder and flux for soldered joints in potable water piping shall be “lead free”, containing not more than 0.2% lead free

1.5 SUBMITTALS

- A. Division 01 Section – “Submittal Procedures”: Submittal Procedures.
- B. Product Data: Submit catalog illustrations of fixtures, sizes, [rough-in dimensions,] utility sizes, trim, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation methods and procedures.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- E. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 Section – “Execution and Closeout Requirements”: Closeout procedures.
- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with all applicable codes, standards, and local authorities having jurisdiction requirements.
- B. Provide products requiring electrical connections listed and classified by Underwriters Laboratories Inc., and/or a testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.
- C. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 50 miles of Project.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience, approved by manufacturer and with service facilities within 50 miles of project.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section – “Product Requirements”: Product storage and handling requirements.
- B. Accept fixtures on site in factory packaging. Inspect for damage.
- C. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.11 WARRANTY

- A. Division 01 Section – “Execution and Closeout Requirements”: Product warranties and product bonds.
- B. Furnish two (2) year manufacturer warranty for plumbing fixtures.

1.12 EXTRA MATERIALS

- A. Division 01 Section: “Execution and Closeout Requirements:” Spare parts and maintenance products.
- B. Furnish two sets of: faucet washers’ flush valve service kits lavatory supply fittings, shower heads, and toilet seats.

1.13 DEFINITIONS

- A. Lead Free:
 - 1. The pipes, pipe fittings, plumbing fittings or fixtures in plumbing systems that are intended to dispense potable water for human consumption, including drinking and cooking, shall be “lead free”, containing not more than a weighted average of 0.25% lead with respect to the wetted surfaces.
 - 2. Solder and flux for soldered joints in potable water piping shall be “lead free”, containing not more than 0.2% lead free

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. Furnish and install all fixtures and trim necessary to complete fixture installation. Provide approved stop valve, to match fittings, on both hot and cold water supplies to each fixture, all fixtures requiring hot and cold water shall have cold water faucets on right and hot water faucets on left. Exposed metal work shall be chrome plated red brass. Fixtures shall be white, unless otherwise specified. (Note: The “P” identification symbol with each fixture identified type shown on drawings.) Where fixtures tailpieces, traps and stop valves are not indicated, same shall be provided to suit fixture.
- B. Unless otherwise specified, the specified fixtures are taken from the catalogue of Zurn for convenience only. Provide similar fixtures of American Standard, Crane, Eljer Company, Elkay, Kohler, Sloan or an acceptable comparable product.
- C. Coordinate flush valve mounting heights for all water closets with the locations of grab bars; refer to Architectural Contract Drawings for exact grab bar locations.
- D. Refer to Architectural Drawings for mounting heights of all fixtures.

PLUMBING FIXTURES

- E. All exposed bolts, screws, fasteners, etc. shall be vandal proof.
- F. Utilize Sani-Sett setting compound for fixtures.
- G. All plumbing materials, equipment and fixtures shall be new and of best grade, free of defects and complete with all required appurtenances and accessories.
- H. Provide supports necessary to adequately and substantially hang and set fixtures. Supports shall be Zurn, Watts, Josam or J.R. Smith and shall be suitable for wall types and thicknesses and piping arrangements shown.
 - 1. Support for wall mounted, urinals, lavatories, sinks, water coolers, etc.:
 - a. Where fixtures are supported from concrete or cinder block walls, install No. 10 USSG steel plate on the opposite side of the wall and bolt hangers or supports through plate. Where opposite side of wall is exposed to view, place bolts in core of blocks and fill core with cement.
 - b. Where lavatories with wall hangers have been specified and fixtures are supported from metal stud frame partitions, fixture brackets or mounting lugs shall be through bolted to steel channel crosspieces not less than 1 ½" wide anchored to studs. Bolt heads shall be welded to channel web.
 - c. Concealed arm type lavatory supports, Zurn Z1231, or Watts TCA-411 with cast iron headers, box steel stanchions, block type cast iron tee and header and chrome plated cast brass threaded escutcheons for slab type lavatories.
 - 2. Wall mounted water closet chair carriers, Watts ISCA-101 series or Zurn Z-1203 Series for horizontal installation.
- I. Plumbing fixtures shall be caulked at walls and floors with silicone caulking material of same color as fixture(s).
- J. Locate countertop sinks and/or under counter sinks furnished under this Division. Furnish templates to the countertop fabricator for cutting of required holes.
- K. For sinks and fixtures specified under other divisions or other contracts and not provided with faucets, tailpieces, traps, stop valves and supply tubes, provide necessary fittings and completely connect the sinks and fixtures.
- L. Where sensor operated flush valves and faucets are specified hereinafter, furnish transformer(s) to serve the maximum recommended number of fixtures per the fixture manufacturer's recommendations. Each transformer shall be suitable for a 120v primary voltage. Wiring shall be installed under Division 26.
- M. Hot and cold water connections to fixtures shall be provided with a stop valve, stop valves, flexible braided risers, etc. Stop valves shall be ¼ turn and brass type: ½ "nominal compression inlet x 3/8" O.D. compression outlet, ¼ turn angle valve, 1 piece body construction, chrome plated, compatible with copper, cross-linked polyethylene, temperature rating: 40°F to 140°F, pressure rating: 125 PSI, no lead certified, IAPMO and CSA listed to ASME A 112.18.1/CSA B 125.1 as manufactured by Brasscraft Mfg. Co: Model: G2CR19 or an acceptable comparable product as manufactured by Chicago Faucet, or McGuire.

PLUMBING FIXTURES

- N. Refer to specification section "Pipes and Tubes for Plumbing Piping and Equipment", for tempered water public hand washing, bathtub, and shower mixing valve requirements. All public hand washing fixtures to be provided with ASSE 1070 Mixing Valve. All bathtub and shower fixtures to be provided with ASSE 1016 Mixing Valve.
- O. Provide piping, fittings, drain pans and components to provide washing machine overflow protection. Install per applicable code(s) and/or the authority having jurisdiction's requirements. Provide drain pans under washing machines with indirect connections to drainage system.
1. Water Closets – Floor Mounted – Flush Valve Operated
 - a. P-1 Water Closet (ADA): American Standard Madera FloWise TS (top spud), vitreous china toilet with direct fed siphon jet action, floor mounted elongated bowl, 1.28 gpf toilet with standard white cover with stainless steel check hinge open front seat. Chrome supply and stop.
 - 1) Flush valves:
 - a) Manual Flush Valve – American Standard Model 6047.121 TS (top spud)
 2. Lavatories – Wall Hung:
 - a. P-2 Lavatory: American Standard Model No. 0355.012, 20½" x 18¼" x 12-1/8" or Sloan Model No. SS3003 white vitreous china or Zurn Model No. Z5344, 4" center faucet spacing splash back lavatory with 27" clearance below waste outlet to accommodate wall hanger or concealed arm supports. Fixture shall comply with ADA requirements. Provide with lead free faucet stop valves, and flexible risers. Provide adjustable P trap with cleanout, trap nipple, and escutcheon. Provide with concealed arm wall hanger system and pipe support legs.
 - 1) Faucets:
 - a) Faucet – One-piece, cast brass construction above-deck with various finishes, 4" centercet, vandal resistant aerator, valdal resistant below-deck box, battery powered (AA), 0.5 GPM vandal-resistant multi-stream laminar flow
(1) MOEN M-Power CA8301
 - b) Supply pipes and drain shall be protected by 3/16" thick white molded all vinyl internally ribbed insulation with access for stop valves, trap, etc.
(1) Plumberex – X4333/2003
(2) Trubro 105/102
 3. Countertop Sink (ADA):
 - a. P-3 Lavatory: American Standard Model No. 0476.028 20-3/8" x 17-3/8 x 7" white vitreous china oval self-rimming/drop-in countertop lavatory, or Zurn Model No. Z5114, with 4" centers fitted with lead free faucet stop valves and flexible supply pipe risers. Provide adjustable P trap with cleanout, trap nipple and escutcheon.
 - 1) Faucets:
 - a) Faucet – One-piece, cast brass construction above-deck with various finishes, 4" centercet, vandal resistant aerator, valdal resistant below-

PLUMBING FIXTURES

deck box, battery powered (AA), 0.5 GPM vandal-resistant multi-stream laminar flow
(1) MOEN M-Power CA8301

4. Service Sink:

- a. P-4:
 - 1) PROFLO, model number PFLT2123.
 - 2) 21"x23"x13" plastic composite floor-mounted with leveling device legs.
 - 3) Provide the following:
 - a) Service faucet by Delta, model number 2123LF
 - b) Flat stainless steel strainer no. "PF93SS".
 - 4) Provide deep seal trap.

2.2 FIRE RATED PLUMBING ENCLOSURES

- A. One hour rated wall enclosure to protect shower valves installed in rated walls. Product shall comply with ASTM E-119, UL263, NFPA 251, ANSI A2.1, UBC 7-1, and ULC S101. Fire Rated Product Specialties Corp FN-Z-14-14-3 Fire Enclosure or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements": Coordination and project conditions.
- B. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- C. Verify electric power is available and of correct characteristics.
- D. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install Work in accordance with all applicable codes, standards, and local authorities having jurisdiction requirements.
- B. Install each fixture with trap, easily removable for servicing and cleaning.

- C. Provide chrome plated flexible braided supplies to fixtures with ¼ turn handle stops, loose key, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall supports or wall carriers and bolts as recommended by fixture manufacturer.
- F. Seal joints between fixtures and walls, floors and counters using sanitary type one part mildew resistant sealant. Color to match fixture.
- G. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.
- H. For ADA accessible water closets, install flush valve with handle to wide side of stall.
- I. Provide piping, fittings, drain pans and components to provide washing machine overflow protection. Install per applicable code(s) and/or the authority having jurisdiction's requirements. Provide drain pans under washing machines with indirect connections to drainage system.
- J. Provide fire rated plumbing enclosures at locations where valves, including shower valves, are installed in rated walls.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

- A. Division 01 Section: "Execution and Closeout Requirements": Testing, adjusting, and balancing requirements.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Division 01 Section: "Execution and Closeout Requirements": Final cleaning requirements.
- B. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Division 01 Section: "Execution and Closeout Requirements": Protecting installed construction.
- B. Do not permit use of fixtures before final acceptance.

3.8 SCHEDULES

- A. Refer to contract drawings for plumbing fixture schedule.
- B. Fixture Rough-in: Refer to plumbing fixture schedule on contract drawings

END OF SECTION

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PRODUCT DATA SHEET 0 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 23.

1.2 SUMMARY

- A. Section includes:
1. General administrative and procedural requirements, as well as the following basic mechanical materials and methods.
 2. Submittals.
 3. Record documents.
 4. Operation and Maintenance manuals.
 5. Rough-ins.
 6. Mechanical installations.
 7. Cutting and patching.
 8. Concrete equipment base construction requirements.
 9. Equipment nameplate data requirement.
 10. Labeling and identifying mechanical systems and equipment is specified in Division 23 Section: "Identification for HVAC Piping and Equipment."
 11. Non-shrink grout for equipment installations.
 12. Field-fabricated metal and wood equipment supports.
 13. Installation requirements common to equipment specification Sections.
 14. Mechanical demolition.
 15. Touchup painting and finishing.

1.3 ACRONYMS

- A. The following list of abbreviations are utilized within the specifications and are provided as a reference:
1. AABC - Associated Air Balance Council
 2. ADA - American Disability Act
 3. ADC - Air Diffusion Council
 4. AGA - American Gas Association
 5. AMCA - Air Moving and Conditioning Association
 6. ANSI - American National Standards Institute
 7. ARI - Air Conditioning and Refrigeration Institute
 8. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers

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9.	ASME	-	American Society of Mechanical Engineers
10.	ASTM	-	American Society for Testing and Materials
11.	AWS	-	American Welding Society
12.	AWWA	-	American Water Works Association
13.	IBC	-	International Building Code
14.	CS	-	Commercial Standard
15.	CSA	-	Canadian Standards Association
16.	IBR	-	Institute of Boiler and Radiator Manufacturers
17.	IEEE	-	Institute of Electrical and Electronics Engineers
18.	IMC	-	International Mechanical Code
19.	IPC	-	International Plumbing Code
20.	MOSHA	-	Maryland Occupational Safety and Health Administration
21.	MSSP	-	Manufacturers Standards Society of the Valve and Fittings Industry
22.	NEC	-	National Electrical Code
23.	NEMA	-	National Electrical Manufacturers Association
24.	NFPA	-	National Fire Protection Association
25.	OSHA	-	Occupational Safety and Health Administration
26.	SMACNA	-	Sheet Metal and Air Conditioning Contractors National Association
27.	TEMA	-	Tubular Exchanger Manufacturers Association
28.	UL	-	Underwriters' Laboratories

1.4 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term product includes the terms material, equipment, system, and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes proposed by Contractor in products, materials, equipment, and methods of construction required by the Contract Documents.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named, or a product is accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

- D. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- E. Extended Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.5 SYSTEM DESCRIPTION

- A. Design Requirements: Contract drawings are generally diagrammatic and do not indicate all offsets, fittings, transitions, access panels and other specialties required.
 - 1. Furnish and install all items as may be required at no additional cost to fit the work to the conditions encountered.
 - 2. Arrange piping, ductwork, equipment and other work generally as shown on the contract drawings, providing proper clearances and access.
 - 3. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawing submittal for approval in accordance with Submittals specified below.
 - 4. Subject to the provisions of Division 01, Architect may make reasonable changes in location of equipment piping and ductwork up to the time of rough-in or fabrication.

1.6 SUBMITTALS

- A. Comply with Division 01 Section: "Submittal Procedures".
- B. Shop Drawings and Product Data:
 - 1. Clearly identify all submittals:
 - a. Indicate intended application, location, etc.
 - b. Each submittal shall indicate the associated specification section, and paragraphs. Do not combine product data and shop drawing submittals from different spec sections into a single submittal package, even though they may be the same distributor, vendor or part of a single material order.
 - c. Clearly indicate the exact type, model number, size and special features of the proposed item.
 - d. Include catalog spec sheets to completely describe proposed equipment.
 - e. Factory order forms only showing the required capacities are not acceptable.
 - f. Identify all options furnished to meet specifications.
 - g. The Architect shall not select equipment ratings and/or options. Submittals not properly marked shall be returned without review.
- C. Product Substitutions: Comply with requirements of Division 01.
- D. Comparable Products Submission:
 - 1. Document each request for a proposed comparable product with supporting data substantiating compliance of proposed product with Basis-of-Design product.

E. Closeout Submittals:

1. Record Drawings: Prepare record documents in accordance with the requirements in Division 01 Section: "Execution and Closeout Requirements". In addition to the requirements specified in Division 01, indicate the following installed conditions:
 - a. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.
 - b. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 23 Section: "Identification for HVAC Piping and Equipment." Indicate actual inverts and horizontal locations of underground piping.
 - c. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
 - d. Approved substitutions, Contract Modifications, Responses to Contractor's Request for Information, and actual equipment and materials installed.
 - e. Record the locations and invert elevations of underground installations.
2. Operation and Maintenance Data: Prepare operation and maintenance data in accordance with Division 01 Section: "Execution and Closeout Requirements." In addition to the requirements specified in Division 01, include the following information for equipment items:
 - a. List of systems and equipment requiring service manuals.
 - b. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
 - c. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 - d. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - e. Servicing instructions and lubrication charts and schedules.
 - f. Systems and Equipment test reports.
3. Commissioning Report.

F. Color Selection: Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.

G. Products and Materials:

1. Submit complete descriptive data for all materials as follows:
 - a. Material specifications.
 - b. Data sheets.
 - c. Samples.
 - d. Capacity ratings.
 - e. Performance curves.
 - f. Operating characteristics.

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- g. Catalog cuts.
 - h. Dimensional drawings.
 - i. Wiring diagrams.
 - j. Installation instruction.
 - k. Any other information necessary to indicate compliance with contract documents.
 - 2. Edit submittal data specifically for application to this project.
 - 3. Submit actual operating conditions and characteristics for all equipment.
 - 4. Catalogs or catalog cuts are not acceptable unless the particular item and all relative data has been marked in such a manner as to be clearly defined.
 - 5. Color of finishes shall be as selected by the Architect. Submit colors of factory finished equipment for acceptance prior to ordering.
 - 6. No mechanical item shall be fabricated, purchased, delivered to the site or installed, until reviewed by the Architect.
 - a. After the proposed materials have been approved, no substitution will be permitted except where approved by the Architect.
 - 7. Provide shop drawing and product data submittals as indicated under individual specification sections.
 - 8. Provide any other equipment requested by the Architect.
- H. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.7 QUALITY ASSURANCE

- A. Underwriter's Laboratory (UL) Requirements: All equipment containing electrical components and provided under Division 23 shall bear the Underwriter's Laboratory (UL) label, as a complete packaged system.
- 1. Equipment not provided with a UL label shall be tested in the field, certified and provided with a listed label at the installer's expense.
 - a. Field testing shall be performed by a testing agency approved by the authority having jurisdiction.
 - b. Provide services of a UL recognized, independent Electrical Testing Laboratory (ETL) to provide field inspection and testing. Provide and ETL Label on all such equipment.
- B. Fire Safe Materials: Unless otherwise indicated, materials shall conform to UL, National Fire Protection Agency (NFPA) or American Society for Testing and Materials (ASTM) standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with Division 01 Section: "Product Requirements" : Product storage and handling requirements.

1. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
2. Schedule delivery to minimize long-term storage at Project Site and to prevent overcrowding of construction spaces.
3. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
4. Deliver products to Project Site in 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.
5. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected.
6. Store products in manner that will facilitate inspection and measurement.
7. Store materials in a manner that will not endanger project structure.
8. Store products subject to damage by elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation.
9. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather protection requirements for storage.

1.9 PROJECT CONDITIONS

- A. Existing Conditions: Prior to preparing the bid, visit the site and become familiar with all existing conditions. Make all necessary investigations as to locations of utilities and all other matters, which can affect the work. No additional compensation will be made for failure to determine the conditions under which the work will be performed.
- B. Outages
 1. All mechanical outages which will interfere with the normal use of the building in any manner shall be done at such times as shall be mutually agreed upon with the Owner.
 2. Unless otherwise specified, outages of any services required for the performance of this contract and affecting areas other than the immediate work area shall be scheduled with the Owner at least fourteen days (14) days in advance. All such outages shall be performed on other than normal work hours, Monday through Friday 8 a.m. to 5 p.m.
 3. The bid price shall include the cost of all premium time required for outages and other work which interferes with the normal use of the building.
 4. The operation of valves or switches required to achieve an outage shall be accomplished by the Owner. Unauthorized operation of valves, power switches, or other control devices shall not be permitted.

1.10 SEQUENCING

- A. Coordinate mechanical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

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- D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
- E. Coordinate connection of electrical services.
- F. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
- G. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.
- H. Coordinate installation of identifying devices after completing covering and painting where devices are applied to surfaces. Install identifying devices prior to installing acoustical ceilings and similar concealment.

1.11 PRODUCT WARRANTIES

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds
- B. 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.
- C. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include project-specific information and properly executed.
 - 2. Refer to Divisions 01 through 26 Sections for specific content requirements and particular requirements for submitting special warranties.
- D. Submittal Time: Comply with requirements in Division 01 Section: "Execution and Closeout Requirements."

1.12 DISCREPANCIES

- A. Where discrepancies occur between the drawings and specifications or within either document itself, the item or arrangement of better quality, greater quantity or higher cost shall be included in the contract price. The Architect shall decide on the item and manner in which the work shall be provided, based on the design intent of the documents.

1.13 SPECIAL TOOLS & OPERATING ACCESSORIES

- A. Whenever any products provided under this Division have tamperproof, special or restrictive hardware, as specified or where provided from the manufacturer as standard or optional construction, provide a minimum of two (2) matching tools, bits, sockets, etc. needed for operation and/or access to such items. This shall include, but is not limited to:
1. Tamperproof screws, bolts, etc. on devices, enclosures, covers, etc.
 2. Penta-head bolts used on handhole and/or manhole lids.
 3. Penta-head bolts used on switchgear, transformers, etc.
 4. Any other special tools which are unique to that product.

1.14 PRE-SUBMITTAL MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-Installation Meeting.
- B. Pre-Submittal Meetings: After approval of the material and equipment list and prior to submitting equipment (boilers, chillers, cooling towers, variable speed drives, building automatic temperature control system, and remote energy management system, etc.) shop drawings, the pre-submittal coordination meeting(s) shall be held at the Engineer's Office. The attendees shall include at the minimum:
1. Equipment Sales Representative responsible for the preparing the shop drawings
 2. Mechanical Contractor
 3. Building ATC Contractor (Sales Representative, Control Engineer, and Lead Project Installation Technician)
 4. Electrical Contractor
 5. Mechanical Engineer
- C. The Equipment Representative and/or the Mechanical Contractor shall be responsible for e-mailing, a minimum of 48 hours in advance, a copy of the Preliminary Submittal to all named parties. The purpose of the meeting is to coordinate requirements and gain a full understanding from all parties as to what is required for a fully turnkey installation, as well as to minimize potential rejection of shop drawings. The Mechanical Contractor shall coordinate these meetings and shall document and publish minutes of all meetings."

1.15 Utility Rebate Application:

- A. The contractor shall provide and submit a utility rebate application to the local utility (BGE Smart Energy Program, or other local utility serving this project area) for the major HVAC equipment. The rebate application shall include all information required by the utility company program administrator including, but not limited to, the application, supporting calculations, analysis, comparison of proposed equipment to base line equipment or system, etc.: all as defined and/or required by the program administrator. The owner shall be listed on the application as the recipient of the full rebate.

PRODUCT DATA SHEET 1 - PRODUCTS

1.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with Contract Documents that are undamaged and new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Where products are accompanied by the term as selected, Architect will make selection.
 - 4. Where products are accompanied by the term match sample, sample to be matched is Architect's.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. General Compliance Requirements: Compliance requirements for individual products, as indicated in Contract Documents, are multiple in nature and may include generic descriptions, performance requirements, compliance with reference standards, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with.
- C. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Document requirements, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.
- D. Products specified by Reference Standards, Codes and Regulations: Select from among products, which can be shown to comply with referenced documents.
- E. Products specified by Naming Products and Manufacturers: Select from among products listed.
- F. Products specified by Naming One Manufacturer's Product as the Basis-of-Design with Reference to Other Manufacturers: Select either the specified Basis-of-Design product or an approved comparable product by one of the other named manufacturers.
 - 1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named manufacturers.
- G. Products specified by Naming One Manufacturer's Product and Indicating Option of Selecting Comparable Products by stating or Approved Equivalent or similar language: Select either the specified product or an approved comparable product.
 - 1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named or un-named manufacturers.

- H. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and, matches Architect's sample. Architect's decision will be final on whether proposed product matches satisfactorily.
- I. Visual Selection Specification: Where Specifications include the phrase as selected from manufacturer's standard colors, patterns, textures or similar phrase, select a product that complies with other specified requirements. Architect will select color, pattern, and texture.
 - 1. Standard Range: Where Specifications include the phrase standard range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - 2. Full Range: Where Specifications include the phrase full range of colors, patterns, textures or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

1.2 COMPARABLE PRODUCTS

- A. Where Basis-of-Design products are specified by name, submit the following, in addition to other required submittals, to obtain approval of a comparable product by one of the named manufacturers:
 - 1. Evidence that the proposed product does not require extensive 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 the Basis-of-Design product in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, serviceability, 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.

1.3 GROUT

- A. Non-shrink, Nonmetallic Grout: ASTM C 1107, Grade B, "Packaged Dry, Hydraulic-Cement Grout (Nonshrink)", "latest edition".
 - 1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory-packaged.

1.4 ACCESS DOORS AND PANELS

- A. Provide manufactured steel door assemblies consisting of:

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1. Hinged door.
 2. Flush screwdriver camlocks and frame.
- B. Doors shall be Milcor Metal Access doors. Provide key locks where indicated.
- C. Design shall be provided for the following installations:
1. Masonry or Dry Wall: Style M.
 2. Hard Finish Plaster: Style AP.
 3. Fire rated dry wall ceilings: Style CFRAD, 1 hour combustible floor ceiling system, 1 hour non-combustible floor ceiling system, 3 hour non-combustible floor ceiling system.
 4. Suspended ceilings: Style CT.
 5. Security: Style 3211.

PRODUCT DATA SHEET 2 - EXECUTION

1.1 PREPARATION

- A. Interface With Site Utility Companies:
1. Contact MISS UTILITY prior to any excavation or underground work.
 2. Contact local utility companies (gas, water, sewer, etc.) immediately upon award of contract. Do not install related equipment until fully coordinated with appropriate utilities.
 3. Provide all construction schedules, dates of requested services, outage windows, equipment locations, etc. necessary for utility work.
 4. Gas Utility:
 - a. Coordinate service entrance equipment and related layout with gas company prior to ordering or installing any equipment or systems.
 - b. Furnish and install all incoming concrete pads, sleeves, connections, etc.

1.2 INSTALLATION

- A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:
1. Coordinate mechanical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where systems, materials and equipment are intended for overhead installation, and where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
 7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
 8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
 9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.
 10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.
 11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section: "Access Doors and Frames" and within this section.
 12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- B. Rough-In
1. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 2. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.
- C. Housekeeping and Equipment Pads
1. Construct pads of dimensions indicated, but not less than 4 inches larger than supported unit in both directions. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psi, 28-day compressive strength concrete and reinforcement bars as specified in Division 03 Section: "Cast-in-Place Concrete."
- D. Erection of Metal Supports and Anchorage
1. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
 2. Field Welding: Comply with AWS D1.1, "Structural Welding Code -Steel", "latest edition".
- E. Erection of Wood Supports and Anchorage
1. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
 2. Select fastener sizes that will not 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 members.
 3. Attach to substrates as required to support applied loads.

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F. Grouting

1. Install nonmetallic non-shrink grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's printed instructions.
2. Clean surfaces that will come into contact with grout.
3. Provide forms for placement of grout, as required.
4. Avoid air entrapment when placing grout.
5. Place grout to completely fill equipment bases.
6. Place grout on concrete bases to provide a smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout according to manufacturer's printed instructions.

G. Lintels

1. Lintels shall be provided for openings in masonry, brick, concrete, etc. walls to accommodate work of this division.
 - a. Lintels shall be provided under this division when not being provided under other divisions. Lintels shall be approved by the Architect.

1.3 CUTTING AND PATCHING

- A. General: Perform cutting and patching in accordance with Division 01 Section: "Execution and Closeout Requirements". In addition to the requirements specified in Division 01, the following requirements apply:
1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
- B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
1. Uncover Work to provide for installation of ill-timed Work.
 2. Remove and replace defective Work.
 3. Remove and replace Work not conforming to requirements of the Contract Documents.
 4. Remove samples of installed Work as specified for testing.
 5. Install equipment and materials in existing structures.
 6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect observation of concealed Work.
- C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, ductwork, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.
- D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

- F. Patch finished surfaces and building components using new materials specified for the original installation and using experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

1.4 PAINTING AND FINISHING

- A. Division 09 Section: "Painting and Coating" for field painting requirements.
- B. Damage and Touch Up: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
- C. Do not paint manufacturer's labels or tags.

1.5 MECHANICAL DEMOLITION

- A. Disconnect, demolish, and remove work specified under Division 23 and as indicated. Remove pipes and ducts back to the active pipe and duct to remain and cap.
- B. Where pipe, ductwork, insulation, or equipment to remain is damaged or disturbed, remove damaged portions and install new products of equal capacity and quality.
- C. Accessible Work: Remove indicated exposed pipe and ductwork in its entirety.
- D. Abandoned Work: Cut and remove buried pipe abandoned in place, 2 inches beyond the face of adjacent construction. Cap and patch surface to match existing finish.
- E. Removal: Remove indicated equipment from the Project site.
- F. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.

1.6 PENETRATION OF WATERPROOF CONSTRUCTION

- A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls and interior waterproof construction.
- B. Furnish and install drains, curbs, vent assemblies, sleeves, flashing, etc. specifically designed for application to the particular construction. Install system in accordance with the roofing manufacturer's instructions.

1.7 EXCAVATION AND BACKFILLING

- A. General
 - 1. Perform all necessary excavation, for installation of work under Division 23, in accordance with Division 31.

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1.8 CLEANING

- A. Clean surfaces prior to application of insulation, adhesives, coating, and paint.
- B. Provide factory applied finish where specified.
- C. Protect all finishes, and restore all finishes to their original condition if damaged as a result of work under Division 23.
- D. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces.
- E. General: General cleaning during construction is required by the General Conditions and included in Section Temporary Facilities.
- F. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
- G. Remove all mechanical clipping, wiring, nuts, bolts, etc. left on top of ceilings and ceiling tiles.

1.9 PROTECTION

- A. Protect work, material and equipment from weather and construction operations before and after installation.
- B. Properly store and handle all materials and equipment.
- C. Cover temporary openings in piping, ductwork and equipment to prevent the entrance of water, dirt, debris, and other foreign matter.

1.10 LUBRICATION

- A. All bearings, motors and all equipment requiring lubrication shall be provided with accessible fittings.
- B. Before turning over the equipment to the Owner, provide the following:
 - 1. Fully lubricate each item of equipment.
 - 2. Provide 1 year's supply of lubricant for each type of lubricant.
 - 3. Provide complete written lubricating instructions, together with diagram locating the points requiring lubrication.
- C. Motors and equipment shall be provided with grease lubricated roller or ball bearings with Alemite or equal extended grease fittings and drain plugs.

1.11 ELECTRICAL WORK

- A. It is the intent to provide a complete and operational system. The work between Division 23 and 26 is complementary and is meant to produce a single and operating system. Contractor shall make its own determination as to the distribution of responsibility among the various trades.
- B. All electrical work performed under Division 23 shall be provided in accordance with Division 26.

1.12 PROVISIONS FOR ACCESS

- A. Furnish and install adequate access to all HVAC and plumbing components. The following list shall be used as a guide only:
 - 1. Mechanical equipment.
 - 2. Valves.
 - 3. Dampers and operators.
 - 4. Filters.
 - 5. Heating and air conditioning units.
 - 6. Controls.
 - 7. Cleanouts.
 - 8. Traps.
 - 9. Automatic temperature control panels.
 - 10. Coils.
- B. Access shall be adequate as determined by the Architect.
- C. Refer to contract drawings where panels have been specifically located.
- D. Provide additional panels for adequate access as indicated in paragraph A above.
- E. Where access is by means of liftout ceiling tiles or panels mark each panel using small color-coded or numbered tabs. Provide an index chart for identification. Place markers in corner of tile.

1.13 OPERATION OF EQUIPMENT

- A. Clean all systems and equipment prior to initial operation for testing and balancing.
- B. Do not operate equipment unless all proper safety devices or controls are operational.
- C. Provide all maintenance and service for equipment, which is operated during construction.
- D. Where specified and otherwise required, provide the services of a manufacturer's factory trained service organization to start the equipment.
- E. Do not use mechanical systems for temporary services during construction unless authorized in writing by the Architect.

1. Where such authorization is granted, temporary use of equipment shall not limit or otherwise affect warranties or guarantees of the work.
- F. Upon completion of work, clean and restore all equipment to new conditions and replace all filters.

1.14 DEMONSTRATION

- A. Demonstrate operation and maintenance of equipment and systems to Owner's personnel a minimum two (2) weeks prior to date of final inspection.
1. For equipment requiring seasonal operation, perform instructions for other seasons at the same time.
 2. Training period shall be performed within 1 - two week period.
- B. Use operation and maintenance manuals and video as basis of instruction. Review contents of manual and video with personnel in detail to explain all aspects of operation and maintenance.
- C. Demonstrate the following:
1. Start up.
 2. Operation.
 3. Control.
 4. Adjustment.
 5. Trouble shooting.
 6. Servicing.
 7. Maintenance.
 8. Shutdown.
- D. Provide at least 40 hours straight time instruction to the operating personnel.
1. This instruction period shall consist of not less than five-8 hour days.
 2. Time of instruction shall be designated by the Owner.
 3. This instruction shall be in addition to instructional requirements of specific equipment specified elsewhere in Division 23.

1.15 WALL AND FLOOR PENETRATION

- A. All penetrations of partitions, walls and floors by ducts, piping or conduit under Division 23 shall be sealed and caulked. Provide U.L. listed fire stopping systems at penetrations through fire rated walls.

1.16 EQUIPMENT PROVIDED UNDER ANOTHER DIVISION AND BY OTHERS

- A. Make all system connections required to equipment furnished and installed under another division and by others.

- B. It shall be the responsibility of the Contractor to coordinate all necessary data from the equipment supplied under other Divisions.

1.17 MECHANICAL EQUIPMENT SERVICE PLATFORMS

- A. Where mechanical equipment is located on a roof or elevated structure that requires access such that personnel will have to climb over ductwork or higher than 16 feet above grade to access the equipment, a means to access the equipment shall be provided.
- B. Provide catwalks around the entire perimeter of equipment to match manufacturer required clearance area. Minimum 36" from perimeter of unit
- C. Provide side edge railings that extend above the catwalk not less than 30" above the catwalk

1.18 PROJECT PUNCH OUT

- A. Architect/Engineer will perform punch out reviews and will provide the Contractor with a list of punch list items to be completed before contract close out. Each and every punch list item shall be initialed and dated by the Contractor when the work is complete. The Architect/ Engineer will not perform any punch list verification until all items have been completed, initialed, dated and the list returned to the Architect/Engineer. If any items have been initialed as being completed by the Contractor and the Architect/Engineer determines that the work is not complete, the Architect/Engineer shall be reimbursed by the Contractor at his regular hourly rate for any and all items requiring revisiting of the site by the Architect/Engineer. Reimbursement will be made by deducting the Architect/Engineer fee from the Contractor's final payment.

END OF SECTION

COMMON WORK RESULTS FOR HVAC

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SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section, and the other sections of Division 23.

1.2 SUMMARY

- A. Section includes:
 - 1. Section includes single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.
 - 2. Source Quality Control.
 - 3. Bearing Protection Ring.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 23 Section: "Common Work Results for HVAC."
 - 2. Division 23 Section: "Identification for HVAC piping and Equipment."
 - 3. Division 23 Section: "Hydronic Pumps."
 - 4. Division 23 Section: "HVAC Fans."
 - 5. Division 26 Section: "Common Work Results for Electrical"
 - 6. Division 26 Section: "Grounding and Bonding for Electrical Systems."
 - 7. Division 26 Section: "Identification for Electrical Systems."

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. American Bearing Manufacturers Association:
 - 1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- B. National Electrical Manufacturers Association:
 - 1. NEMA MG 1 - Motors and Generator.
- C. International Electrical Testing Association:

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.4 SUBMITTALS

- A. Division 01 Section – “Submittal Procedures”: Submittal Procedures.
- B. Product Data: Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, and support points.
- C. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.
- D. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years experience.
- B. Testing Agency: Company who is a member of the International Electrical Testing Association and specializing in testing products specified in this section with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section – “Product Requirements”: Product storage and handling requirements.
- B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.
- C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.
- D. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR MOTORS

- A. General: Requirements below apply to motors covered by this Section except as otherwise indicated.
 1. Motors 3/4 hp and Larger: Three-phase motor as specified below.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

2. Motors Smaller Than 3/4 hp: Single-phase motor as specified below
3. Frequency Rating: 60 Hz.
4. Voltage Rating: Determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
 - a. 120 V Circuit: 115 V - motor rating.
 - b. 208 V Circuit: 200 V - motor rating.
 - c. 240 V Circuit: 230 V - motor rating.
 - d. 480 V Circuit: 460 V - motor rating.
5. Minimum service factor shall be 1.15 and shall apply at frequency and utilization voltage at which motor is connected. Provide motors, which will not operate in service factor range when supply voltage is within 10 percent of motor voltage rating.
6. Capacity: Sufficient to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100 percent of rated capacity.
7. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
8. Enclosure: Open dripproof, unless otherwise specified. Provide screen over slots, where slots will permit passage of human extremities.
9. Provide adjustable motor slide base for belt driven equipment. Include adjusting bolts and locknuts.
10. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.
11. Motors that operate with Variable Frequency Drives to meet the MG 1 Part 31 specifications with insulation that can withstand 1600 V peak voltage and a 1 msec rise time and improved bearing lubrication for higher temperature operation

B. Minimum nominal full load efficiency for NEMA design B motors shall be as follows:

	Open Motors			Enclosed Motors		
	2-pole	4-pole	6-pole	2-pole	4-pole	6-pole
HP	3600 RPM	1800 RPM	1200 RPM	3600 RPM	1800 RPM	1200 RPM
1	77.0	85.5	82.5	77.0	85.5	82.5
1.5	84.0	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

7.5	88.5	91.0	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93.0	91.7	91.0	92.4	91.7
20	91.0	93.0	92.4	91.0	93.0	91.7
25	91.7	93.6	93.0	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0

- C. Minimum full load efficiency for polyphase small electric motors shall be as follows:

	Open Motors		
	2-pole	4-pole	6-pole
HP	3600 RPM	1800 RPM	1200 RPM
0.25	65.6	69.5	67.5
0.33	69.5	73.4	71.4
0.50	73.4	78.2	75.3
0.75	76.8	81.1	81.7
1.0	77.0	83.5	82.5
1.5	84.0	86.5	83.8
2.0	85.5	86.5	No Req.
3.0	85.5	86.9	No Req.

- D. Minimum full load efficiency for capacitor-start capacitor-run and capacitor-start induction-run small electric motors shall be as follows:

	Open Motors		
	2-pole	4-pole	6-pole
HP	3600 RPM	1800 RPM	1200 RPM
0.25	66.6	68.5	62.2
0.33	70.5	72.4	66.6
0.50	72.4	76.2	76.2
0.75	76.2	81.8	80.2
1.0	80.4	82.6	81.1
1.5	81.5	83.8	No Req.
2.0	82.9	84.5	No Req.
3.0	84.1	No Req.	No Req.

- E. Three-phase Motors

1. NEMA MG 1, Design B, energy-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
2. Insulation System: NEMA Class F.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

3. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
4. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
5. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
6. Sound Power Levels: Conform to NEMA MG 1.
7. Multi-Speed Motors: Separate winding for each speed.
8. Variable Speed Motors for Use With Solid-State Drives: Energy efficient, squirrel-cage induction, design B units and ratings, characteristics, and features coordinated with and approved by drive manufacturer. Motors shall be labeled to indicate that they are provided with inverter duty capability in accordance with the National Electrical Manufacturers Association NEMA MG-1, Part 31.
9. Motors for Reduced Inrush Starting: Coordinate with indicated reduced controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.
10. All motors shall be provided with manufacturer's stamped nameplate, to include all pertinent and capacity data.

F. Single-phase Motors

1. General: Conform to the following requirements except as otherwise indicated.
2. Energy Efficient Motors: One of the following types as selected to suit the starting torque and other requirements of the specific motor application.
 - a. Permanent Split Capacitor.
 - b. Split-Phase Start, Capacitor-Run.
 - c. Capacitor-Start, Capacitor-Run.
3. Shaded-Pole Motors: Use only for motors smaller than 1/20 hp.
4. Internal Thermal Overload Protection for Motors: Protection shall automatically opens the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.
5. Bearings: Belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single phase motors.

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

2.2 SOURCE QUALITY CONTROL

- A. Test motors in accordance with National Electrical Manufacturers Association NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

2.3 BEARING PROTECTION RING

- A. All motors driven by a variable frequency PWM drive shall include a maintenance free, circumferential, conductive micro fiber shaft grounding ring to discharge shaft currents to ground.
- B. Provide AEGIS SGR Bearing Protection Ring as manufactured by Electro Statis Technology.

PART 3 - EXECUTION

3.1 EXISTING WORK

- A. Disconnect and remove abandoned motors.
- B. Maintain access to existing motors and other installations remaining active and requiring access.
- C. Clean and repair existing motors to remain or are to be reinstalled.

3.2 INSTALLATION

- A. General: The following requirements apply to field-installed motors.
 - 1. Install motors in accordance with manufacturer's published instructions and the following:
 - a. Direct Connected Motors: Mount securely in accurate alignment. Connect to driven equipment with coupler of appropriate type and material for the given duty. Coupler shall be selected for high and range of motor application.
 - b. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer recommendations.
- B. Install engraved plastic nameplates in accordance with Division 26.
- C. Ground and bond motors in accordance with Division 26.

3.3 FIELD QUALITY CONTROL

- A. Division 01 Section – "Quality Requirements": Field inspection, testing, adjusting, and balancing.
- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Perform inspections and tests listed in NETA ATS, Section 7.15.

3.4 VARIABLE FREQUENCY MOTORS

- A. Install Bearing Protection Ring in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and the other Sections of Division 23.

1.2 SUMMARY

A. General Requirements

1. Incorporate in construction pipe hangers and supports to manufacturer's recommendations utilizing manufacturer's regular product components, parts, and assemblies.
2. Comply with maximum load ratings with considering for allowable stresses prescribed by ASME B31.1 or MS SP-58.
3. Provide support, guides and anchors that do not transmit unacceptable heat and vibration to building structure.
4. Installation of pipe hangers and supports shall be based upon the overall design concept of the piping system. The support system shall provide for and control the free movement of piping including its movement in relation to the connected equipment.
5. Provide for vertical adjustments after installation of supported material and during commissioning, where feasible, to ensure pipe is at design elevation and slope.

B. Section Includes:

1. Hanger rods.
2. Inserts.
3. Flashing.
4. Equipment curbs.
5. Sleeves.
6. Mechanical sleeve seals.
7. Formed steel channel.
8. Firestopping relating to HVAC work.
9. Firestopping accessories.
10. Equipment bases and supports.
11. Acoustical Sealant.

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

1. Division 03 Section: "Cast-In-Place Concrete": Execution requirements for placement of concrete housekeeping pads specified by this section.
2. Division 03 Section: "Concrete Forming and Accessories": Execution requirements for placement of inserts or sleeves in concrete forms specified by this section.

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3. Division 07 Section: "Firestopping": Product requirements for firestopping for placement by this section.
4. Division 07 Section: "Joint Protection": Product requirements for sealant materials for placement by this section.
5. Division 09 Section: "Painting and Coating": Product and execution requirements for painting specified by this section.
6. Division 23 Section: "Common Work Results for HVAC."
7. Division 23 Section: "Vibration and Seismic Controls for HVAC Piping and Equipment": Product and execution requirements for vibration isolators.
8. Division 23 Section: "HVAC Insulation."

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

American Society of Mechanical Engineers:

1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:

1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
3. ASTM E814 - Test Method of Fire Tests of Through Penetration Firestops.
4. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
5. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:

1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports – Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

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5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):

1. WH - Certification Listings.

1.4 DEFINITIONS

(Unless otherwise noted, references apply to “latest editions.”)

- A. Terminology used in this Section is defined in Manufacturer's Standardization Society Specification 90, “Valve and Fittings Standards.”
- B. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.5 SUBMITTALS

- A. Division 01 Section: “Submittal Procedures”: Submittal procedures.
- B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
- C. Product Data:
 - 1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
 - 2. Firestopping: Submit data on product characteristics, performance and limitation criteria.
- D. Firestopping Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.
- E. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods sealed by a registered professional engineer.
- F. Manufacturer's Installation Instructions:
 - 1. Hangers and Supports: Submit special procedures and assembly of components.
 - 2. Firestopping: Submit preparation and installation instructions.
- G. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- H. Firestopping Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by licensed professional engineer suitable for presentation to authority having jurisdiction for acceptance as meeting code fire protection requirements.

- I. Welder certificates signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.
- J. Submit following in accordance with Conditions of Contract and Division 1 Specifications:
 - 1. Shop drawings of items.
 - 2. Complete description of products to be supplied including product data, dimensions materials of construction and specifications.
 - 3. Installation instructions for each product.
 - 4. Layout of piping and ductwork to be isolated including vertical risers showing:
 - a. Support points.
 - b. Weight at support points.
 - c. Isolator type.
 - d. Static deflection expected under actual load.
 - e. Specified static deflection.
 - f. Additional deflection to solid under actual load.
 - g. Ratio of spring height under load to spring diameter.
 - 5. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method and location of equipment attachment bolts.
 - 6. Special details at large scale and other necessary information to convey understanding of work.
- K. Submission of samples may be requested for each type of vibration isolation device. After approval, samples shall be returned for installation at job site.
- L. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements": Closeout procedures.
- B. Project Record Documents: Record actual locations of valves, equipment and accessories.
- C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.7 QUALITY ASSURANCE

(Unless otherwise noted, references apply to "latest editions.")

- A. Listing and Labeling: Provide hangers and supports that are listed and labeled as defined in NFPA 70 "Definitions."
 - 1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7, "Definition and requirements for a nationally recognized testing laboratory."

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

- B. Licensed Operators: Use operators that are licensed by powder-operated tool manufacturers to operate their tools and fasteners.
- C. Supply and install incidental materials needed to meet requirements, even if not expressly specified or shown on drawings without claim for additional payment.
- D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.
- E. Should any rotating equipment cause excessive noise or vibration, rebalance, realign or do other remedial work to reduce noise and vibration levels. Excessive is defined as exceeding manufacturer's specifications for unit in question.
- F. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - 1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.
 - 2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1-hour.
 - a. Floor Penetrations Within Wall Cavities: T-Rating is not required.
- G. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.
 - 1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.
 - 2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.
- H. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- I. Perform Work in accordance with ASME B31.1 and ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- J. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements" for transporting, handling, storing, and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.
- C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section: "Product Requirements": Environmental conditions affecting products on site.
- B. Do not apply firestopping materials when temperature of substrate material and ambient air are not in accordance with the manufacturer's installation procedures.
- C. Maintain manufacturer's required temperature before, during, and after installation of firestopping materials for minimum periods of time as required by the manufacturer.
- D. Provide ventilation in areas to receive solvent cured materials.

1.12 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.13 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

(Unless otherwise indicated, references apply to "latest editions.")

2.1 MATERIALS

- A. Structural Steel: ASTM A 36, "Carbon Structural Steel," steel plates, shapes, and bars, black and galvanized.
- B. Bolts and Nuts: ASME B18.10 or ASTM A 183, "Track Bolts and Nuts," steel, hex-head, track bolts and nuts.
- C. Washers: ASTM F 844, "Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use," steel, plain, flat washers.
- D. Grout: ASTM C 1107, Grade B, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)," non-shrink, nonmetallic.
 - 1. Characteristics include post-hardening, volume-adjusting, dry, hydraulic-cement-type grout that is non-staining, noncorrosive, nongaseous and is recommended for both interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Water: Potable.
 - 4. Packaging: Premixed and factory-packaged.

2.2 HANGERS AND SUPPORTS

- A. Hangers, Supports, and Components: Provide factory-fabricated products as manufactured by B-Line, Tyco – (Anvil Hangers), Pipe Shields, Inc., or Erico CADDY. Basis of Design shall be B-Line.
 - 1. Components include galvanized coatings where installed for piping and equipment that will not have a field-applied finish.
 - 2. Pipe attachments include nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 4-1 through 4-3 and Figures 4-1 through 4-8.
- C. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.
- D. Support vertical ducts at a maximum interval of 16 feet and at each floor.
- E. Upper attachments to structures shall have an allowable load not exceeding 3 of the failure (proof test) load but are not limited to the specific methods indicated.
- F. Horizontal Non-Insulated Copper Piping Hangers:
 - 1. Two inch and smaller: Figure No. B3104 CTC.
 - 2. Two and one-half inch and larger: Figure No. B3104 CT.
- G. Insulated Horizontal Piping Hangers: Reheat Water, Glycol Solution, Heating Hot Water, steam and condensate return, refrigerant piping:

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1. Two inch and smaller: Figure No. B3108 with metal shield, Figure No. B3151.
2. Two and one-half inch and larger: Figure No. B3108 with metal shield, Figure No. B3151.

H. Beam Clamps and Attachments:

1. For bolt-on locations to structure, Figure Nos. B3291, B3036, or B3050.
2. Welded beam attachments, Figure No. B3083.

I. Brackets:

1. For equipment and piping adjacent to walls or steel columns, Figure Nos. B3066, B3063 and B3067 depending on weight to be supported.

J. Pipe Rests:

1. For pipes close to floor where no expansion provision is required, Figure No. B3088T base stand with B3093 adjustable pipe saddle support.

K. Hanger Rods:

1. Hanger rod, Figure No. B3205.
2. Continuous threaded rod, Figure No. ATR.
3. Eye rods, Figure No. B3210 or B3211, depending on load supported.

L. Trapeze Hangers - Direct Mounting Hangers:

1. Grinnell, Figure No. 46.

M. Protection Saddles:

1. Cast iron pipe, insulated, Figure No. B3108 with metal shield, Figure No. B3151.
2. For high temperature steel pipe, insulated, No. B3160, B3161, B3162, B3163, B3164, or B3165.

N. Pipe Roll Stands:

1. For support of pipe where axial movement is encountered: Figure No. B3117SL where no vertical adjustment is required; and Figure No. B3118SL where vertical adjustment is required.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
1. Carpenter & Paterson, Inc.
 2. Erico/Michigan Hanger Co.

3. PHS Industries, Inc.
 4. Pipe Shields, Inc.
 5. Rilco Manufacturing Company, Inc.
 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FLASHING

- A. Metal Flashing: 26 gage thick galvanized steel.
- B. Metal Counterflashing: 22 gage thick galvanized steel.
- C. Lead Flashing:
1. Waterproofing: 5 lb./sq. ft sheet lead.
 2. Soundproofing: 1 lb./sq. ft sheet lead.
- D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.
- E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements

2.5 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- E. Sealant: Acrylic

2.6 MECHANICAL SLEEVE SEALS

- A. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

- A. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

2.8 ACOUSTICAL SEALANT

- A. Sealants for acoustical purposes shall be one of following non-setting sealants:

Acoustical sealant.....D.A.P.
BR – 96 Pecra
Acoustical sealant Tremco
Acoustical sealant U.S.G.

PART 3 - EXECUTION

(Unless otherwise noted, references apply to “latest editions.”)

3.1 EXAMINATION

- A. Division 01 Section: “Administrative Requirements”: Verification of existing conditions before starting work.
- B. Verify openings are ready to receive sleeves.
- C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material. Install damming material to arrest liquid material leakage.
- B. Install damming materials to arrest liquid material leakage.
- C. Remove incompatible materials affecting bond.
- D. Drilling or cutting of structural members shall be as detailed / directed by structural engineer.

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3.3 INSTALLATION - INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Comply with MSS SP-69 "Pipe Hangers, and Supports C Selection and Application", and SP-89, "Pipe Hangers and Supports - Fabrication and Installation Practices". Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Piping shall be supported independently from equipment connections. Supports shall not interfere with removal of equipment.
- B. Arrange for grouping of parallel runs of horizontal piping supported together on field-fabricated, heavy-duty trapeze hangers where possible.
- C. Install supports with maximum spacings complying with MSS SP-69, "Pipe Hangers, and Supports C Selection and Application" and as specified in Division 23 Section: "Pipes and Tubes for HVAC Piping and Equipment."
- D. Where pipes of various sizes are supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
- E. Install building attachments within concrete or to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69, "Pipe Hangers, and Supports C Selection and Application". Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts in new construction prior to placing concrete. Install reinforcing bars through openings at top of inserts.
- F. Install powder-actuated drive-pin fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Does not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.
- G. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install according to fastener manufacturer's written instructions. Do not use in lightweight concrete slabs or in concrete slabs less than 4 inches (100 mm) thick.

- H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- I. Heavy-Duty Steel Trapezes: Field-fabricate from ASTM A 36, "Carbon Structural Steel," 2001, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1, "Structural Welding Code – Steel."
- J. Install hangers and supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- K. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.
- L. Place hangers within 12 inches of each horizontal elbow.
- M. Use hangers with 1-1/2 inch minimum vertical adjustment.
- N. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- O. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- P. Support riser piping independently of connected horizontal piping.
- Q. Provide copper plated hangers and supports for copper piping.
- R. Design hangers for pipe movement without disengagement of supported pipe.
- S. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- T. Provide clearance in hangers and from structure and other equipment for installation of insulation.
- U. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- V. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so that maximum pipe deflections allowed by ASME B31.9 "Building Services Piping" is not exceeded.
- W. Insulated Piping: Provide continuous insulation and vapor barrier through hangers and supports. Comply with the following installation requirements.
 - 1. Riser Clamps: Attach riser clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9. Insulate clamps on piping with insulation and vapor barrier.
 - 2. Saddles: Install protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.
 - 3. Shields: Install MSS Type 40, protective shields on cold piping with vapor barrier. Shields span an arc of 180 degrees (3.1 rad) and have dimensions in inches (mm) not less than the following:

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NPS (Inches)	LENGTH (Inches)	THICKNESS (Inches)
1/4 to 3 1/2	12	0.048
4	12	0.060
5 and 6	18	0.060
8 to 14	24	0.075
16 to 24	24	0.105

4. Pipes 4 Inches and Larger: Include treated wood inserts.
5. Insert Material: Length to equal to the length of the protective shield.
6. Conform to the table below for maximum spacing of supports and rod sizes:

a. Steel and Copper Pipe:

Nom. Pipe Size – In.	Steel Pipe Max. Span – Ft.	Copper Tube Max. Span – Ft.	Min. Rod Dia. – In.
Up to 3/4	7	5	3/8
1	7	6	3/8
1 1/4	7	7	3/8
1 1/2	9	8	3/8
2	10	8	3/8
2 1/2	11	9	1/2
3	12	10	1/2

b. Support vertical steel pipe and copper tube at each floor.

X. Equipment Supports:

1. Fabricate structural steel stands to suspend equipment from structure above or support equipment above floor.
2. Grouting: Place grout under supports for equipment and concrete bases. Make a smooth bearing surface.
3. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6" beyond supported equipment.
4. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

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5. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
6. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for pipe 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 manual shielded metal-arc welding, appearance and quality of welds, methods used in correcting welding work, and 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 that no roughness shows after finishing, and so that contours of welded surfaces match adjacent contours.

3.6 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 3 ½" thick and extending 6" beyond supported equipment.
- B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed. Refer to Division 22 Section: "Vibration and Seismic Controls for Plumbing and Equipment."

3.7 INSTALLATION - FLASHING

- A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.
- D. Seal floor drains and floor sinks watertight to adjacent materials.

- E. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.8 INSTALLATION - SLEEVES

- A. Exterior watertight entries: Seal with mechanical sleeve seals.
- B. Set sleeves in position in forms. Provide reinforcing around sleeves.
- C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- D. Extend sleeves through floors 2 inches above finished floor level. Caulk sleeves.
- E. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with firestopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- F. Install stainless steel escutcheons at finished surfaces.

3.9 FIELD QUALITY CONTROL

- 1. Division 01 Section: "Quality Requirements": Field inspection, testing, adjusting, and balancing.
- 2. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.10 CLEANING

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for cleaning.
- B. Clean adjacent surfaces of firestopping materials.

3.11 PROTECTION OF FINISHED WORK

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for protecting finished work.
- B. Protect adjacent surfaces from damage by material installation.

3.12 APPLICATIONS FOR HANGER AND SUPPORT

- A. Specific hanger requirements are specified in the Section specifying the equipment and systems.
- B. Comply with MSS SP-69, "Pipe Hangers and Supports C Selection and Application," for pipe hanger selections and applications that are not specified in piping specification Sections.

3.13 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Adjust for pipe alignment and final equipment connections. Flexible connections shall not be used for adjustment of alignment.

END OF SECTION

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IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section, and the other sections of Division 23.

1.2 SUMMARY:

- A. Section Includes:
 - 1. Engraved Plastic-Laminate Signs.
 - 2. Valve Tags.
 - 3. Painted Identification Materials
 - 4. Plastic Pipe Markers.
 - 5. Ceiling Tacks
 - 6. Plasticized Tags.
 - 7. Duct Markers.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 09 Section: "Painting and Coating": Execution requirements for painting specified by this section.
 - 2. Division 23 Section: "Common Work Results for HVAC."
 - 3. Division 23 Section: "Refrigerant Piping."
 - 4. Division 23 Section: "HVAC Air Distribution."
 - 5. Division 23 Section: "HVAC Fans."

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. American Society of Mechanical Engineers:
 - 1. ASME A13.1 - Scheme for the Identification of Piping Systems.
- B. National Fire Protection Association:
 - 1. NFPA 99 - Standard for Health Care Facilities.

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1.4 SUBMITTALS

- A. Division 01 Section – “Submittal Procedures”: Submittal Procedures.
- B. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.
- C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.
- E. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8 1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. Furnish copies for Maintenance Manuals as specified in Division 01 Section: "Execution and Closeout Requirements
- F. Maintenance Data: Include product data and schedules in maintenance manuals, in accordance with requirements of Division 01.
- G. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.
- H. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- I. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Codes and Standards:
 - 1. ANSI Standards: Comply with ANSI A13.1, for lettering size, length of color field, colors, and viewing angles of identification devices.

C. Equipment Lettering and Graphics:

1. General: Coordinate names, abbreviations and other designations used in HVAC identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of HVAC systems and equipment.
 - a. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification, which indicates individual system number as well as service (for example; Unit Heater No. 3).

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum five years documented experience approved by manufacturer.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish two containers of spray-on adhesive.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering identification materials which may be incorporated in the work include, but are not limited to, the following:

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

- B. Manufacturer: Subject to compliance with requirements, provide HVAC identification materials of one of the following:
1. Brady (W.H.) Co.; Signmark Div.
 2. Industrial Safety Supply Co., Inc.
 3. Seton Name Plate Corp.

2.2 MATERIALS:

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selections is Installer's option, but provide single selection for each product category.
- B. Provide pipe markers with the following background colors and designations:

SERVICE	STENCIL DESIGNATION	LETTER COLOR	BACKGROUND COLOR	JACKET
Refrigerated Suction	Refrigerant Suction	Black	Safety Orange	Black
Refrigerated Liquid	Refrigerant Liquid	Black	Safety Orange	Black

2.3 ENGRAVED PLASTIC-LAMINATE SIGNS (Nameplates):

- A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
- B. Thickness: 1/8", except as otherwise indicated.
- C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.
- D. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
1. Name and plan number.
 2. Equipment service.
 3. Design capacity.
 4. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.
- E. Size: Provide approximate 2 1/2" x 4" markers for control devices, dampers, and valves; and 4 1/2" x 6" for equipment.

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2.4 VALVE TAGS:

- A. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
 - 1. Provide 1 1/2" sq. black tags with white lettering, except as otherwise indicated.
 - 2. Provide size, shape and color combination as specified or scheduled for each piping system.
- B. Plastic Valve Tags: Provide manufacturer's standard solid plastic valve tags with printed enamel lettering, with piping system abbreviation in approximately 3/16" high letters and sequenced valve numbers approximately 3/8" high, and with 5/32" hole for fastener.
 - 1. Provide 1 1/8" sq. white tags with black lettering.
 - 2. Provide size, shape and color combination as specified or scheduled for each piping system.
- C. Metal Tags:
 - 1. Brass with stamped letters; tag size minimum 1-1/2 inches square with finished edges.
- D. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- E. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame

2.5 PAINTED IDENTIFICATION MATERIALS:

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inch high letters.
 - 2. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1-inch high letters.
 - 3. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
 - 4. Ductwork and Equipment: 1-3/4 inches high letters.
- B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
- C. Identification Paint and Background Color; Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems and HVAC equipment comply with ANSI A13.1 for colors. For ductwork, use green paint. For hazardous exhaust, use colors per ANSI A13.1.

2.6 PLASTIC PIPE MARKERS:

- A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, UV-resistant color-coded pipe markers, complying with ANSI/ASME A13.1

- B. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - 1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - 2. Adhesive lap joint in pipe marker overlap.
 - 3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1 1/2".
- C. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
 - 1. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1 1/2" wide; full circle at both ends of pipe marker, tape lapped 3".
 - 2. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.
- D. Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length. Operating pressure of steam systems shall be indicated.
 - 1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.7 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color-coded head.
- B. Color code as follows:
 - 1. HVAC equipment: Yellow.
 - 2. Fire dampers/smoke dampers: Red.
 - 3. Plumbing valves: Green.
 - 4. Heating/cooling valves: Blue.

2.8 PLASTICIZED TAGS:

- A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, of plasticized card stock with matt finish suitable for writing, approximately 3 1/4" x 5 5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.9 DUCT MARKERS:

- A. Identify air: supply, return, exhaust, intake and relief ducts with duct markers or provide stenciled signs and arrows showing service and direction of air flow.

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

1. Locate signs near points where ducts enter into concealed spaces and at maximum intervals of 25 feet.
2. Provide identification labels at access panels to locate concealed duct accessories.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 Section: "Painting and Coating"

3.2 INSTALLATION:

- A. General:
 1. Coordination: Where identification is to be applied to surfaces, which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
 2. Confined Spaces: Provide labels and signs on all duct and equipment doors, plenums, etc. to indicate service and provide operator warnings as required by OSHA, NFPA, and authority having jurisdiction.
- B. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- C. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- D. Piping System Identification:
 1. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - a. Plastic pipe markers, with application system as indicated under "Materials" in this section.
 2. Locate pipe markers and color bands as follows on all piping in occupied spaces, above ceilings, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for equipment and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - c. Near locations where pipes pass through walls or floors/ ceilings, or enter non-accessible enclosures.
 - d. At access doors, manholes and similar access points, which permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

- f. Spaced intermediately at maximum spacing of 25' along each piping run, except reduce spacing to 10' in congested areas.
- E. Valve Identification:
 - 1. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, and shut-off valves at HVAC equipment. List each tagged valve in valve schedule for each piping system.
- F. Equipment Identification:
 - 1. General: Install engraved plastic laminate sign on or near each major item of HVAC equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - a. Main control and operating valves, including safety devices and hazardous units.
 - b. Flow meters.
 - c. Fuel-burning units.
 - d. Pumps, compressors, and similar motor- driven units.
 - e. Heat exchangers, expansion tanks, and similar equipment.
 - f. Tanks and pressure vessels.
 - 2. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
 - 3. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety precautions, and warn of hazards and improper operations.
- G. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- H. Identify control panels and major control components outside panels with plastic nameplates.
- I. Identify air terminal units and radiator valves with numbered tags.
- J. Tag automatic controls, instruments, and relays. Key to control schematic.
- K. Apply stencil painting in accordance with Division 09 Section: "Painting and Coating"
- L. Identify ductwork with stenciled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- M. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

3.3 ADJUSTING:

- A. Adjusting: Relocate any identification device, which has become visually blocked by work of this division or other divisions.

3.4 CLEANING:

- A. Cleaning: Clean face of identification devices.

3.5 EXTRA STOCK:

- A. Furnish minimum of 5% extra stock of each identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
 - 1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including the General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section and the other Sections of Division 22.

1.2 SUMMARY

- A. Coordinate work of this section with all trades.
- B. Work covered in this Section shall be performed after completion of work specified in all Divisions as they related to this work.
- C. Review of design drawings and specifications, and comment on potential problem areas.
- D. Site inspections of ongoing plumbing installation with written report from each visit.
- E. Air leak testing of ductwork system. See Division 23 Section: "HVAC Air Distribution."
- F. Section Includes:
 - 1. Testing adjusting, and balancing of air systems.
 - 2. Testing adjusting, and balancing of hydronic and refrigerating systems.
 - 3. Measurement of final operating condition of HVAC systems.
 - 4. Sound measurement of equipment operating conditions.
 - 5. Vibration measurement of equipment operating conditions.
- G. Coordinate with all trades to provide all incidental items not indicated on drawings or in specifications that belong to work described or are required for complete systems balancing, at no additional cost to Owner.
- H. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 23 Section: "Instrumentation and Control for HVAC": Requirements for coordination between DDC System and Testing, Adjusting, and Balancing, and Sequences of operation.
 - 2. Division 23 Section: "Common Work Results for HVAC": Execution Requirements, Closeout Requirements.
 - 3. Division 01 Section: "Commissioning".

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1.3 REFERENCES

- A. Associated Air Balance Council:
 - 1. AABC MN-1-National Standards for Testing and Balancing, Heating, Ventilating, and Air Conditioning Systems.
- B. American Society of Heating Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE Research Report No. 1162, Air Flow Measurements at Intake and Discharge Openings and Grilles, ASHVE Transactions, Volume 46.
 - 2. ASHRAE Handbook of Fundamentals.
 - 3. ASHRAE Standard 70 (RA 2011), Method of Testing the Performance of Air Outlets and Air Inlets.
 - 4. ASHRAE 111 – Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning and Refrigeration Systems.
- C. American National Standards Institute (ANSI) Publications:
 - 1. ANSI/AIHA Z9.5 American National Standard for Laboratory Ventilation.
- D. Natural Environmental Balancing Bureau:
 - 1. NEBB – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
 - 2. ANSI S1.4 - -Specification for Sound Level Meters.
 - 3. ANSI S1.11 – Specification for Octave, Half Octave, and Third Octave Band Filter Sets.
 - 4. ANSI S1.13 – Measurement of Sound Pressure Levels in Air.
 - 5. ANSI S1.40 – Verification Procedures for Sound Calibration.
- E. Testing Adjusting and Balancing Bureau:
 - 1. TABB – International Standards for Environmental Systems Balance.
- F. Sheet Metal and Air Conditioning Contractors National Association Inc.:
 - 1. (SMACNA) – Air Duct Leakage Test Manual.
- G. Scientific Equipment and Furniture Association (SEFA) Standard SFA I-1998 Laboratory Fume Hoods.
- H. National Institute of Standards and Technology:
 - 1. NIST

1.4 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Agency Data:

1. Submit proof that proposed testing, adjusting, and balancing agency meets the qualifications specified within 30 days of award of contract.
- C. Engineer and Technicians Data:
1. Submit proof that Test and Balance Engineer assigned to supervise procedures, and technicians proposed to perform procedures meet qualifications specified within 30 days of award of contract.
- D. Procedures and Agenda: Submit synopsis of testing, adjusting, and balancing procedures and agenda proposed to be used for this project within 90 days of award of contract.
1. Prior to commencing work, submit report forms or outlines indicating adjusting, balancing, and equipment data required. Include detailed procedures, agenda, sample report forms, and copy of AABC National Project Performance Guaranty, NEBB Certificate of Conformance Certification, or TABB International Quality Assurance program guarantee.
- E. Document Review:
1. Submit certification in writing that all design drawings and specifications have been reviewed, and comment on potential problems within 90 days of award of contract.
- F. Maintenance Data: Submit maintenance and operating data that include how to test, adjust, and balance the building systems. Include this information in maintenance data specified in Division 01 and Division 23 Section: "Common Work Results for HVAC."
- G. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of Test and Balance Engineer. Reports shall be certified proof that systems have been tested, adjusted, and balanced in accordance with referenced standards; are an accurate representation of how systems have been installed; are true representation of how systems are operating at completion of testing, adjusting, and balancing procedures; and are accurate record of final quantities measured, to establish normal operating values of the systems. Follow procedures and format specified below:
1. Report Format: Report forms shall be those standard forms prepared by referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Divide contents of binder into divisions listed below, separated by divider tabs:
 - a. General Information and Summary
 - b. Air Systems
 - c. Automatic Temperature Controls
 - d. Special Systems
 - e. Sound and Vibration Systems
 2. Report Contents: Provide following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Include certification sheet containing seal and name address, telephone number, and signature of Certified

- Test and Balance Engineer. Include in this division listing of the instrumentations used for the procedures along with proof of calibration.
- b. Remainder of the report shall contain appropriate forms containing as minimum, information indicated on standard report forms prepared by AABC and NEBB, for each respective item and system. Prepare schematic diagram for each item of equipment and system to accompany each respective report form.
- H. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- I. NIST Calibration Reports: Submit proof that all testing and balancing instruments and equipment used for this project has been calibrated in accordance with NIST Standards, within period of twelve months prior to starting project.
1. For pharmaceutical GMP facilities, certified cleanrooms, etc. calibration period shall be within six (6) months.
- J. Submit draft copies of report for review prior to final acceptance of Project.
- K. Furnish reports complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- L. Final submittal shall include but not be limited to following:
1. List of equipment used to perform test and procedures.
2. Equipment performance data and equipment curves with actual points of performance indicated on curves as compiled during balancing.
3. Air Devices including VAV Boxes (supply, return and exhaust) and all air outlets.
4. Duct traverse readings during balancing.
5. Room sound pressure levels.
6. Hydronic, domestic hot water, and steam system components flow rates, pressures and temperatures.
7. On balance report documents record date and time of reading.
8. Field verification of fume hood face velocities based on SEFA test procedure.
- M. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements": Closeout procedures.
- B. Project Record Documents: Record actual locations of flow measuring stations, balancing valves, and rough setting.
- C. Operation and Maintenance Data: Furnish final copy of testing, adjusting, and balancing report inclusion in operating and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with Authority Having Jurisdiction requirements.
- B. Agency Qualifications:
 - 1. Employ services of independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance the building heating, ventilating and air conditioning systems to produce design objectives. Services shall include checking installations for conformity to design, measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications, and recording and reporting results.
 - 2. Certified by National Environmental Balancing Bureau (NEBB) or by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project, and having at least one Professional Engineer registered in State in which services are to be performed, certified by NEBB or AABC as Test and Balance Engineer.
- C. Work shall be accomplished in accordance with specifications. Procedures specified shall be followed and, if not specifically described herein, in general, shall be in accordance with Associated Air Balance Council's National Standards or National Environmental Balancing Bureau's Procedural Standards.
- D. Design Review:
 - 1. Review all design drawings and specifications. Review shall include:
 - a. Duct pressure classification.
 - b. Control device location and balancing devices location in duct systems and piping systems.
 - c. Indicate additional balancing devices required for proper balancing.
 - d. Specifications on all devices required for balancing.
 - e. Note any potential noise problems.
 - 2. Within 90 days of award of contract, meet with the Architect, Mechanical Contractor, and Building Automation System Contractor to review procedures and agenda and comments on design documents as to potential problem areas.
- E. Shop Drawing Review:
 - 1. Review "Instrumentation and Control for HVAC" shop drawing submittals noting any potential balancing problems. Note comments on submittal, sign, stamp and return to General Contractor. All "Instrumentation and Control for HVAC" submittals must be reviewed by balancing agency prior to review by Architect.
- F. Pre-Balancing Conference: Prior to beginning of testing, adjusting, and balancing procedures, schedule and conduct conference with Architect and representatives of installers of mechanical systems. Objective of conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.
- G. During construction, balancing agency shall inspect the installation of pipe systems, temperature controls, and other component parts of heating, ventilating, and air conditioning systems.

Inspections shall be performed periodically as work progresses. Minimum of two inspections are required as follows: (1) when 60 percent of ductwork is installed; (2) when 90 percent of equipment is installed. Balancing agency shall submit brief written report of each inspection to Owner and Architect.

1.7 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum five years' experience certified by AABC, NEBB, or TABB.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.9 SEQUENCING

- A. Division 01 Section: "Summary Of Work" : Work sequence.
- B. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.10 SCHEDULING

- A. Division 01 Section: "Administrative Requirements": Coordination and project conditions.
- B. Schedule and provide assistance in final adjustment and test of life safety, smoke evacuation, or smoke control system with Fire Authority.

1.11 OWNER'S INSTRUCTIONS

- A. Balancing contractor's technician along with his balancing engineer shall provide four (4) hours of instruction to Owner's engineers on balancing methods, procedures and equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements": Coordination and project conditions.
- B. Preliminary Work:

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1. Inspect project site prior to starting adjustments to verify completion of trades, including general construction, piping system, ductwork system, building automation systems, and electrical systems, as they relate to balancing work. Verify systems are complete and operable before commencing work. Verification shall include but not be limited to following:
 - a. Systems are started and operating in safe and normal condition.
 - b. Ductwork System:
 - 1) Duct joints sealed.
 - 2) Witness leakage tests required under sheet metal section.
 - 3) Dampers and control devices installed.
 - 4) Duct systems are clean of debris.
 - 5) Fire and volume dampers are in place and open
 - c. Proper direction of rotation for motor-driven equipment and for proper speed on multi-speed motors.
 - 1) Fans are rotating correctly.
 - 2) Pumps are rotating correctly.
 - d. Balancing devices are installed and accessible.
 - e. Control device connections.
 - 1) HVAC control systems are installed complete and operable.
 - f. Note problems in general construction of the building that might effect systems performance such as sealing of windows, building joints, exhaust shafts, etc.
 - g. Problems discovered during this inspection shall be reported to General Contractor and Owner.
 - h. Proper thermal overload protection is in place for electrical equipment.
 - i. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - j. Air coil fins are cleaned and combed.
 - k. Access doors are closed and duct end caps are in place.
 - l. Air outlets are installed and connected.
2. Contractor shall certify in writing that each piping system has been prepared as per this Section, indicating dates procedures were done and which contractor did work. Submit in writing to Architect before beginning balancing work.

3.2 PREPARATION

- A. Furnish instruments required for testing, adjusting, and balancing operations.
- B. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

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3.3 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.
- B. Air Outlets and Inlets: Adjust total to within plus or minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 5 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

- A. Division 01 Section: "Execution and Closeout Requirements": Testing, adjusting, and balancing.
- B. Verify recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.
- E. Report defects and deficiencies noted during performance of services, preventing system balance.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

3.5 SYSTEM BALANCE - GENERAL REQUIREMENTS

- A. Balance heating, ventilating, and air conditioning to obtain air and water quantities indicated and required for proper operation of system.
- B. Field work performed under this Section shall be provided under direct supervision of a Registered Professional Engineer.
- C. Furnish services for complete adjustment of water systems, steam systems and air handling and exhaust systems, water, steam and air distribution and controls.
- D. During all tests, it shall be demonstrated that systems shall be free from leaks and all parts of system will operate correctly. If not, report deficiencies to Contractor and Owner. Balancing Firm shall make final adjustments to equipment as may be required for proper operation, maintaining correct temperatures in all parts of the building. Controls shall be adjusted by "Instrumentation and Control for HVAC" technicians in conjunction with Balancing Firm. Coordinate setpoints and adjustments with "Instrumentation and Control for HVAC."

- E. Balancing of hydronic systems and parts installed under this Contract to obtain water quantities and temperature drops in all parts of system shown on plans, in specifications on approved shop drawings or as required by Architect.
- F. Balancing of heating and air conditioning, special exhaust and ventilating systems to achieve air quantities specified at each air inlet, outlet, or damper shown on plans at proper conditions of static pressure and temperature differential.
- G. Study and report on excessive noise conditions, which may develop during system balancing. Report shall be sent to Architect.

3.6 AIR SYSTEM BALANCE

- A. Prior to air balance, witness duct leak tests as performed under Division 23 Section: "HVAC Air Distribution."
- B. In conjunction with Division 23 "Instrumentation and Controls for HVAC," equipment shall be started per design sequence. Determine fan airflow at rated speed. If airflow is not within 10% of design capacity of rated speed, review system conditions, procedures, and recorded data. Check and record pressure drops across filters, compensate for clean versus dirty filters, coils, sound traps, airflow sensors, etc., to indicate excessive pressure loss or leakage. Resolve problems with appropriate contractor. If systems are properly operating, and airflow is still unacceptable, adjust fan drive in accordance with manufacturer's recommendations to obtain proper airflow and static pressure. Systems shall be balanced and operated at lowest feasible static pressure with allowance for filter loading. Record fan suction pressure, fan discharge pressure, amperage and airflow measurement. Correct fan curves to indicate new points of balance. Fan motor shall not be overloaded.
- C. With fan systems adjusted and dampers set to handle normal minimum outdoor air, perform following tests and compile following information:
 - 1. Air Handling Equipment:
 - a. Design Conditions
 - 1) Supply, Return and Exhaust Airflow
 - 2) Static and Total Pressure
 - 3) Outdoor Airflow
 - 4) Motor rating
 - 5) Fan speed
 - 6) Outlet Velocity
 - b. Installed Equipment
 - 1) Manufacturer
 - 2) Motor serial number
 - 3) Motor type and efficiency, rating, voltage, phase, full-load amperes.
 - c. Field Test
 - 1) Fan Speed
 - 2) No-load operating amperes
 - 3) Fan motor operating amperes
 - 4) Calculated motor output

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- d. Test for Total Air
 - 1) Sum of discharge, exhaust, return air and outside air ducts.
 - 2) Number and locations of velocity readings taken.
 - 3) Duct average velocity
 - 4) Total airflow
 - e. After completion of tests, adjustments, and balancing under minimum outdoor air conditions, set system for 100% outdoor air. Repeat the total airflow tests to check field versus design conditions. Results under 100% outdoor air cycle shall agree with conditions found under "minimum fresh air operation" before system is considered to be in balance. Adjustments of proper dampers shall be made to achieve balance.
- D. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- I. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate and at minimum airflow rate.
- J. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches differential static pressure near building entries.
- K. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.
- L. For variable air volume system powered units set volume controller to airflow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable-air-volume temperature control.
- M. On fan powered VAV boxes, adjust airflow switches for proper operation.
- N. With supply, return, and exhaust systems properly adjusted for airflow and static pressure, conduct following test, adjustments and compilation of data:
- 1. Duct Mains and Branches:
 - a. Adjust, measure and record airflow, static pressure of duct mains and branch ducts to provide required pressure and airflow terminal devices.
 - b. Make air flow rate measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

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2. Terminal Devices:
 - a. Manufacturer, Model No. and Size of airflow control valves (supply, return and exhaust).
 - b. Inlet velocity, static pressure, minimum and maximum airflow setpoints of valves.
 - c. Outlet airflow of valve.
 - d. Adjust minimum or maximum setting of valves as required to obtain required airflow of outlets in accordance with manufacturer's procedures and recommendations.
 - e. In conjunction with "Instrumentation and Control for HVAC", operate controls, i.e., thermostats, switches and pressure controls in accordance with design sequence to verify proper operation.
 - f. Report control problems in writing to the Contractor. Resolve sequence problems with Section "Instrumentation and Control for HVAC", the Contractor and Architect at no additional cost.
3. Air Inlets and Outlets (supply, return and exhaust registers diffusers and grilles)
 - a. Manufacturer, model number, size of outlet and number of throw directions.
 - b. Design and actual airflow.
 - c. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
 - d. Adjust general HVAC systems to design airflow within the following tolerances:
 - 1) Total system supply, return, and exhaust: (design to plus 10 percent).
 - 2) Outdoor air: (minus 5 percent to plus 5 percent).
 - 3) Total supply, return, and exhaust for a room or space: (minus 5 percent to plus 5 percent).
 - 4) Grilles, registers, and diffusers:
 - a) One per room or space: (minus 5 percent to plus 5 percent).
 - b) Two or more per room or space: (minus 10 percent to plus 10 percent).
 - e. Adjust direction of throw as required to match final installation location to prevent drafts.
 - f. With supply, return and exhaust balanced to design airflow, report room pressurization, (positive or negative). Report pressure readings relative to adjacent spaces only where requested by Owner or Architect.

O. Sheaves And Belts:

1. Should the air balance not meet acceptable industry standard tolerances as referenced herein, change and replace sheaves and belts to provide a final acceptable air balance. Replacement of sheaves and belts shall be provided at no additional cost.

P. Airflow Measuring Stations

1. Airflow Measuring Stations shall be field calibrated.

3.7 ACOUSTICS AND NOISE CRITERIA

- A. Verify that mechanical systems comply with noise criteria as specified and indicated in Division 23. Where compliance is questionable or where additional testing requested by Owner, Architect

TESTING, ADJUSTING, AND BALANCING FOR HVAC

or Contractor, take sound pressure level reading and record. Diagnose equipment causing deviations and report deviations to appropriate trade contractor and Contractor. Resolve noise problems with Contractor and appropriate Installer

3.8 SCHEDULES

A. Report Forms

1. Title Page:
 - a. Name of Testing, Adjusting, and Balancing Agency
 - b. Address of Testing, Adjusting, and Balancing Agency
 - c. Telephone and facsimile numbers of Testing, Adjusting, and Balancing Agency
 - d. Project name
 - e. Project location
 - f. Project Architect
 - g. Project Engineer
 - h. Project Contractor
 - i. Project altitude
 - j. Report date
2. Summary Comments:
 - a. Design versus final performance
 - b. Notable characteristics of system
 - c. Description of systems operation sequence
 - d. Summary of outdoor and exhaust flows to indicate building pressurization
 - e. Nomenclature used throughout report
 - f. Test conditions
3. Instrument List:
 - a. Instrument
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Range
 - f. Calibration date
4. Electric Motors:
 - a. Manufacturer
 - b. Model/Frame
 - c. HP/BHP and kW
 - d. Phase, voltage, amperage; nameplate, actual, no load
 - e. RPM
 - f. Service factor
 - g. Starter size, rating, heater elements
 - h. Sheave Make/Size/Bore

5. V-Belt Drive:
 - a. Identification/location
 - b. Required driven RPM
 - c. Driven sheave, diameter and RPM
 - d. Belt, size and quantity
 - e. Motor sheave diameter and RPM
 - f. Center to center distance, maximum, minimum, and actual

6. Air Cooled Condensing Unit:
 - a. Identification/number
 - b. Location
 - c. Manufacturer
 - d. Model number
 - e. Serial number
 - f. Entering DB air temperature, design and actual
 - g. Leaving DB air temperature, design and actual
 - h. Number of compressors

7. Air Moving Equipment:
 - a. Location
 - b. Manufacturer
 - c. Model number
 - d. Serial number
 - e. Arrangement/Class/Discharge
 - f. Air flow, specified and actual
 - g. Return air flow, specified and actual
 - h. Outside air flow, specified and actual
 - i. Total static pressure (total external), specified and actual
 - j. Inlet pressure
 - k. Discharge pressure
 - l. Sheave Make/Size/Bore
 - m. Number of Belts/Make/Size
 - n. Fan RPM

8. Return Air/Outside Air Data:
 - a. Identification/location
 - b. Design air flow
 - c. Actual air flow
 - d. Design return air flow
 - e. Actual return air flow
 - f. Design outside air flow
 - g. Actual outside air flow
 - h. Return air temperature
 - i. Outside air temperature
 - j. Required mixed air temperature

- k. Actual mixed air temperature
- l. Design outside/return air ratio
- m. Actual outside/return air ratio

9. Exhaust Fan Data:

- a. Location
- b. Manufacturer
- c. Model number
- d. Serial number
- e. Air flow, specified and actual
- f. Total static pressure (total external), specified and actual
- g. Inlet pressure
- h. Discharge pressure
- i. Sheave Make/Size/Bore
- j. Number of Belts/Make/Size
- k. Fan RPM

10. Duct Leak Test:

- a. Description of ductwork under test
- b. Duct design operating pressure
- c. Duct design test static pressure
- d. Duct capacity, air flow
- e. Maximum allowable leakage duct capacity times leak factor
- f. Test apparatus
 - 1) Blower
 - 2) Orifice, tube size
 - 3) Orifice size
 - 4) Calibrated
- g. Test static pressure
- h. Test orifice differential pressure
- i. Leakage

11. Air Distribution Test Sheet:

- a. Air terminal number
- b. Room number/location
- c. Terminal type
- d. Terminal size
- e. Area factor
- f. Design velocity
- g. Design air flow
- h. Test (final) velocity
- i. Test (final) air flow
- j. Percent of design air flow

12. Sound Level Report:

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- a. Location
- b. Octave bands - equipment off
- c. Octave bands - equipment on
- d. RC level - equipment on

13. Vibration Test:

- a. Location of points:
 - 1) Fan bearing, drive end
 - 2) Fan bearing, opposite end
 - 3) Motor bearing, center (when applicable)
 - 4) Motor bearing, drive end
 - 5) Motor bearing, opposite end
 - 6) Casing (bottom or top)
 - 7) Casing (side)
 - 8) Duct after flexible connection (discharge)
 - 9) Duct after flexible connection (suction)
- b. Test readings:
 - 1) Horizontal, velocity and displacement
 - 2) Vertical, velocity and displacement
 - 3) Axial, velocity and displacement
- c. Normally acceptable readings, velocity and acceleration
- d. Unusual conditions at time of test
- e. Vibration source (when non-complying)

3.9 CALIBRATION

- A. During testing and balancing, inspect temperature sensors, pressure sensors, digital indicators, and thermometers, etc. provided under Division 23. Report discrepancies to the Contractor for replacement or recalibration.

3.10 RE-BALANCE

- A. After Architect's review of test and balance report submittal, make adjustment in any balancing point as required by Architect, to correct discrepancies between balance report and design, at no additional cost.

3.11 FINAL BALANCE

- A. Visit site within one year after building occupancy if necessary to adjust and rebalance, any system required by Owner, to resolve any and all complaints. After final balance, revise previous submittal and resubmit to architect for record purpose. Rebalance and resubmittals shall be done at no additional cost to Owner.

END OF SECTION

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**SECTION 23 07 00
HVAC INSULATION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the contract, including General and Supplemental Conditions and Division 01 Specifications, apply to this section and the other sections of Division 23.

1.2 SUMMARY

- A. Section includes:

1. Insulation Materials:
 - a. Cellular Glass
 - b. Flexible Elastomeric
 - c. Glass Mineral Wool Blanket Insulation
 - d. High-Temperature, Glass Mineral Wool Blanket Insulation
 - e. Glass Mineral Wool Board Insulation
 - f. High-Temperature Glass Mineral Wool Board Insulation
 - g. Glass Mineral Wool, Preformed Pipe Insulation
 - h. Glass Mineral Wool, Pipe and Tank Insulation
 - i. Polyurethane Foam Board Insulation
2. Insulating cements.
3. Adhesives.
4. Mastics.
5. Lagging adhesives.
6. Sealants.
7. Factory-applied jackets.
8. Field-applied fabric-reinforcing mesh.
9. Field-applied cloths.
10. Field-applied jackets.
11. Tapes.
12. Securements.
13. Corner angles.

- B. Related Sections: The following sections contain requirements that relate to this section.

1. Division 07 Section: "Firestopping": Product requirements for firestopping for placement by this section.
2. Division 09 Section: "Paints and Coatings": Execution requirements for painting insulation jackets and covering specified by this section.
3. Division 23 Section: "Hangers and Supports for HVAC Piping and Equipment": Product and Execution requirements for inserts at hanger locations.
4. Division 23 Section: "Identification for HVAC Piping and Equipment": Product requirements for HVAC piping and equipment identification.

HVAC INSULATION

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1.3 REFERENCES

(Unless otherwise noted, references apply to “latest editions.”)

A. ASTM International:

1. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
3. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
5. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
6. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
7. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
8. ASTM C423 - Standard for Reverberation Room Method.
9. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
10. ASTM C450 - Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging.
11. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
12. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
13. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
14. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation.
15. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
16. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
17. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
18. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
19. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
20. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
21. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation.
22. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
23. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
24. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
25. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).

26. ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation.
 27. ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
 28. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 29. ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks .
 30. ASTM C1617 – Standard Practice for Qualitative Accelerated Laboratory Evaluation of Extraction Solutions Containing Ions Leached from Thermal Insulation on Aqueous Corrosion of Metals.
 31. ASTM 1622 - Standard Test Method for apparent density, apparent density, apparent overall density.
 32. ATSM C1639 – Standard Specification for Fabrication of Cellular Glass Pipe and Tubing Insulation.
 33. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 34. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 35. ASTM D3575 - Standard Test Methods for flexible cellular materials made from Olefin Polymers, closed cell materials, flexible cellular, Olefin Polymers, Buoyancy, etc.
 36. ASTM D4637 - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane.
 37. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
 38. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 39. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
 40. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
 41. ASTM E2231 – Standard Practice for Specimen Preparation of Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics.
 42. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. Sheet Metal and Air Conditioning Contractors':
1. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- C. Underwriters Laboratories Inc.:
1. UL 1978 - Standard for Safety for Grease Ducts.
- D. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE).
- E. North American Insulation Manufacturers Association (NAIMA).
- F. NAIMA – “Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation.”
- G. “National Commercial & Industrial Insulation Standards” – MICA Manual

- H. National Fire Protection Association (NFPA)
- I. Underwriter's Laboratories Environmental (UL Environment).

1.4 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- C. EPD Submittals: As certified by UL Environment.
- D. Samples: Submit two samples of representative size illustrating each insulation type.
- E. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.
- D. Duct insulation, Coverings, and Linings: UL/ULC Classified per UL 723 or Maximum 25/50 flame spread/smoke developed index, when tested in accordance with ASTM E84, using specimen procedures and mounting procedures of ASTM E 2231.
- E. Perform Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.
- F. Fire-Test-Response Characteristics: Insulation and related materials shall be UL/ULC Classified per UL 723 or have fire-test response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke developed index of 50 or less.

- 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke developed index of 150 or less.
- G. Formaldehyde Free: Third party certified with UL Environment Validation.
- H. Biosoluble: As determined by research conducted by the International Agency for Research on Cancer (IARC) and supported by revised reports from the National Toxicology Program (NTP) and the California Office of Environmental Health Hazard Assessment. Certified by European Certification Board for Mineral Wool Products (EUCEB).
- I. Recycled Content: A minimum of 50 percent recycled glass content certified and UL Validated.
- J. Low Emitting Materials: For all thermal and acoustical applications of Glass Mineral Wool Insulation Products, provide materials complying with the testing and products requirements of UL GREENGUARD Gold Certification.
- K. Living Building Challenge-Declare Red List Free.
- L. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE.
- M. Insulation materials shall be tested and rated according to ASTM Test Method C-177 to determine k-factors. ASTM C 335 is for pre-formed pipe insulation. C177 is for flat slab materials ONLY; such as board products, etc.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Requirements for transporting, handling, storing and protecting products.
- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping. Remove and replace any wet or damaged unsatisfactory insulation at the Architect's direction.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section: "Product Requirements": Environmental conditions effecting products on site.
- B. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- C. Maintain temperature during and after installation for minimum period of 24 hours.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds.
- B. Furnish two year manufacturer warranty for manmade fiber.

1.12 DEFINITIONS

- A. Thermal Conductivity (K value): Units of Btu-inch/hour per square foot per degree F.
- B. UL GREENGUARD: Provides independent third party, Indoor Air Quality (IAQ) certification of products for emissions of respirable particles and Volatile Organic Compounds (VOC's), including formaldehyde and other specific product related pollutants. Certification is based upon criteria used by EPA, OSHA, and WHO.
- C. EPA: Environmental Protection Agency.
- D. WHO: World Health Organization.
- E. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with a polypropylene outer film layer leaving no paper exposed.
- F. ASJ: Al-service jacket.
- G. FSK: Foil, scrim, Kraft paper.
- H. FSP: Foil, Scrim, polyethylene.

- I. PVDC: Polyvinylidene chloride.
- J. SSL+: Self-Sealing Lap with Advanced Closure System.
- K. SSL: Self-sealing lap.
- L. ASJ Max: All service jacket composed of aluminum foil with tri-directional reinforcing scrim bonded to Kraft paper with a polypropylene outer layer leaving no exposed paper.
- M. PSK: Poly Scrim Kraft.
- N. PVC: Polyvinyl Chloride.
- O. Glass Mineral Wool: Interchangeable with fiber glass, but replacing the term in the attempt to disassociate and differentiate Glass Mineral Wool from the potential health and safety of special purpose or reinforcement products that do not meet the bio solubility criteria of insulation made from glass. Rock Mineral Wool will replace the traditional Mineral Wool label. Both are used in lieu of the Mineral Fiber label.
- P. ECOSE® Technology: a revolutionary binder chemistry that enhances the sustainability of products. The "binder" is the bond that holds the Glass Mineral Wool product together and gives the product its shape and brown color. ECOSE Technology is a plant based sustainable chemistry that replaces the phenol/formaldehyde (PF) binder traditionally used in Glass Mineral Wool products. Products using ECOSE Technology are formaldehyde free and have greater reduced global warming potential than compared to products of the past.
- Q. UL GREENGUARD Gold Certification: (formerly known as GREENGUARD Children & Schools Certification) offers stricter certification criteria, considers safety factors to account for sensitive individuals (such as children and the elderly), and ensures that a product is acceptable for use in environments such as schools and healthcare facilities. It is referenced; by both The Collaborative for High Performance Schools (CHPS) and the Leadership in Energy Environmental Design (LEED) Building Rating Systems.
- R. UL Environment Formaldehyde Free Verification Requirements: For a product to be verified as formaldehyde free, product samples must have a measured emission factor of less than or equal to 5 µg/m²h at 24 elapsed hours or 3 µg/m²h at 336 elapsed hours. An emission factor of 5 µg/m²h corresponds to measured chamber concentration of 2.5 µg/m³ for a typical building ratio of 0.5 m²/m³. This chamber concentration is comparable to, or below typical outdoor air concentrations. This demonstrates that the formaldehyde exposure from products labeled as formaldehyde free will not contribute to airborne formaldehyde concentrations at greater levels than those found in the natural outdoor environment.
- S. Declare and The Living Building Challenge – The Living Building Challenge is a philosophy, advocacy tool and certification program that addresses development at all scales. The purpose of The Living Building Challenge is to define the most advanced measure of sustainability in the built environment today and acts to diminish the gap between current limits and ideal solutions. Declare supports The Living Building Challenge by providing a transparent materials database that project teams can select from to meet Imperative 11.
- T. Imperative 11, Red List – requires that manufacturers disclose the ingredients in their products to insure that they are free of Red List chemicals and materials. The Red List represents the “worst

in class" materials, chemicals and elements known to pose serious risks to human health and the greater ecosystem.

- U. Underwriters Laboratories Environment (UL Environment): offers independent green claims validation, product assessment and certification. UL GREENGUARD provides third party credibility for sustainable products.
- V. UL Environment Claims Validation (ECV): service and label tests a manufacturer's product and validates that the environmental claims they make in their marketing and packaging materials are factual. This Environmental Claims Validation (ECV) service will allow manufacturers to verify that their products contain a quantifiable amount of recycled content and, as such, help limit raw material extraction and reduce landfill waste. It also will enable products to qualify for LEED® points under Pilot Credit 43: MR – Certified Products.
- W. EUCEB: exonerated fiber from a health and safety standpoint by the European Certification Board process.
- X. Recycled Content: materials such as bottled glass collected at curbside or other collection sites after consumer use and/or materials used or created from one manufacturing process which are collected as scrap and placed back into another manufacturing process rather than being placed in a landfill or incinerated.
- Y. Polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants: have been linked to adverse health effects after exposure in low concentrations.
- Z. UL Classified: UL has tested and evaluated samples of the product with respect to certain properties of the product. UL Classifies products to:
 - 1. Applicable UL requirements.
 - 2. Standards for safety.
 - 3. Standards of other National and International organizations.
- AA. EPD: Environmental Product Declaration. A third party verified document that reports environmental data of products based on the Life Cycle Assessment (LCA) and other relevant information, and in accordance with the International Standard ISO 14025 (Type III Environmental Declarations).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles blow introduce lists, the following requirements apply to product selection.
 - 1. Products: Subject to compliance with requirements, provide one of the products specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

- A. Refer to Part 3 execution schedule for requirements regarding where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury or mercury compounds.
- C. Insulation products shall contain no formaldehyde-based binders or shall be third-party certified for conformance with GREENGUARD Gold or Indoor Advantage Gold. (GREENGUARD Children and Schools is now called GREENGUARD Gold)
- D. When product to be in contact with austenitic stainless steel is tested according to ASTM C795 (which includes ASTM C692 and ASTM C871), the PH of the leach water from the specific material supplied shall be greater than 7.0 but not greater than 11.7 at 77°F. An acceptable proportion of sodium plus silicate ions to the chloride ions as found by leaching from the insulation is shown in the "plot point" of figure 6 in ASTM C795.
- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Insulation materials applied to carbon steel shall be Mass Load Corrosion Rate (MLCR) tested per ASTM 1617.
- G. Foam insulation materials shall not utilize CFC or HCFC blowing agents in the manufacturing process.
- H. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
 - 1. Products:
 - a. Pittsburgh Corning Corporation; FOAMGLASS® ONE™ Insulation.
 - b. Specialty Products & Insulation Company (SPI), Lancaster, PA.
 - 2. Block Insulation: ASTM C 552, Type I.
 - 3. Special-Shaped Insulation: ASTM C 552, Type III.
 - 4. Board Insulation: ASTM C 552, Type IV.
 - 5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C 552, Type II, Grade 6.
 - 6. Maximum K-Factor: 0.29 at 75 deg. F. mean temperature.
 - 7. Factory fabricates shapes according to ASTM C 450 and ASTM C 585.
- I. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products:
 - a. Aeroflex USA Inc.: Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. Nomaco; K-Flex Pipe
 - 2. Water Vapor Permeability: 0.02 perm-inch per ASTM E96 Procedure A.

3. Thermal Conductivity: 0.27 at 75 degrees F
 4. Warranty: 25 year warranty against breakdown of the membrane due to ultraviolet radiation.
 5. Seal Tape: Thermoplastic rubber membrane backed with pressure sensitive adhesive.
- J. Polyester: An engineered nonwoven, thermally bonded Polyester with a smooth and durable FSK facing. Liner must have a noise reduction coefficient of at least 0.65 and have thermal values greater or equal to an R-4/2 at 1", R-5 at 1 1/4", R-6 at 1 1/2" and R-8 at 2" respectively.
1. Products
 - a. Ductmate Industries, Inc.: PolyArmor
 - b. Polyester liner shall be able to withstand a constant internal temperature up to 250°F must be compliant with Greenguard Environmental Institute, and contain zero VOC's per ASTM D5116. Liner shall comply with all applicable standards including ASTM E84, ASTM C518, ASTM G-21, NFPA 90A and 90B, and UL 181.
 - c. Polyester duct liner must be attached using a non-flammable, low VOC water based adhesive. When applicable, apply a non-flammable, low VOC water based lagging adhesive to the exposed leading edge of the insulation. Install fasteners per SMACNA HVAC Duct Liner installation instructions.
 - d. Polyester duct liner must be installed per section 7.4 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal and Flexible," Third Edition unless otherwise specified.
- K. Glass Mineral Wool Blanket Insulation: Glass mineral wool bonded with a thermosetting resin. Comply with ASTM C 553, Types I, II and III, ASTM C 1136, Type II and ASTM C 1290, Type I or Type III, UL/ULC Classified per UL 723 or FHC 25/50 per ASTM E 84. UL GREENGAURD Gold Certified and UL Environment Validated to be formaldehyde free. Product shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE. Factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
1. Products:
 - a. Knauf Insulation; Atmosphere Duct Wrap with Ecosse® Technology
 - b. CertainTeed Corp.; Duct Wrap.
 - c. Johns Manville; Microlite Duct Wrap or Microlite EQ.
 - d. Owens Corning; All-Service Duct Wrap Type 150.
 2. Maximum K-Factor: 0.24 at 75 deg. F. and material thickness compressed 25%.
 3. Minimum Density: 1.5 pounds per cubic foot.
- L. High-Temperature, Glass Mineral Wool Blanket Insulation: Glass mineral wool bonded with a thermosetting resin. Comply with ASTM C 553, Type V, flexible, noncombustible meeting ASTM C 447, without factory-applied jacket.
1. Products:
 - a. Knauf Insulation; Elevated Temperature (ET) Blanket with Ecosse® Technology
 - b. Johns Manville; HTB 23 Spin-Glas.
 - c. IIG Industries (Rock Mineral Wool)
 - d. Owens Corning Utilicore L2.5

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2. Maximum K-Factor: 0.23 at 75 deg. F.
 3. Minimum Density: 2.0 pounds per cubic foot.
- M. Glass Mineral Wool Board Insulation: Glass mineral wool bonded with a thermosetting resin. UL/ULC Classified per UL 723 or FHC 25/50 per ASTM E 84. Comply with ASTM C 612, Type IA or Type IB. Living Building Challenge – Declare Red List Free. For duct and plenum applications, provide insulation with factory-applied FSK jacket. For equipment applications, provide insulation with factory-applied ASJ+ or ASJ. Factory-applied jacket requirements are specified in Part 2 “Factory-Applied Jackets” Article.
1. Products:
 - a. Knauf Insulation; Earthwool Insulation Board with Ecose® Technology for temperatures up to 450° F.
 - b. CertainTeed Corp.; Commercial Board.
 - c. Johns Manville; 800 Series Spin-Glas, Type 814.
 - d. Owens Corning; Fiberglas 700 Series for operating temperatures up to 450°F.
 2. Maximum K-Factor: 0.23 at 75° F.
 3. Minimum density: 2.8 pounds per cubic foot.
- N. High-Temperature Glass Mineral Wool or Rock Mineral Wool Board Insulation: Glass mineral wool or rock mineral wool bonded with a thermosetting resin. Comply with ASTM C 612, Type IA, IB, II – Category I or III, without factory-applied jacket.
1. Products:
 - a. Knauf Insulation: Elevated Temperature Board with Ecose® Technology for operating temperatures to 1000°F.
 - b. Johns Manville: 1000 Series Spin-Glas for temperatures to 850° F.
 - c. IIG Industries
 - d. Rock Wool Manufacturing Company; Delta Board.
 - e. Owens Corning: Insul-Quick for operating temperatures up to 850°F
 - f. Owens Corning: SCR Board for temperatures up to 1000°F
 - g. Owens Corning: Industrial Board for operating temperatures up to 1200°F
 2. Maximum K-Factor: 0.23 at 75 deg. F mean temperature; 0.33 at 300 deg. F mean temperature.
 3. Minimum Density: 2.8 Pounds per cubic foot.
- O. Glass Mineral Wool, Preformed Pipe Insulation:
1. Products:
 - a. Johns Manville: Micro-Lok HP Ultra
 - b. Knauf Insulation: Earthwool 1000 Pipe Insulation with Ecose® Technology.
 - c. Knauf Insulation: Earthwool Redi-Klad 1000 pipe insulation with Ecose® Technology. (for chilled water or outdoor applications)
 - d. Owens Corning; Fiberglas Pipe Insulation SSLII with ASJ Max
 2. Type I, 850 deg F or Type IV, 1000 deg F. Materials: Glass mineral wool bonded with a thermosetting resin. UL/ULC Classified per UL 723 or FHC 25/50 per ASTM E 84. Living Building Challenge – Declare Red List Free for Redi-Klad Pipe or unjacketed Earthwool Pipe only. Comply with ASTM C 585, ASTM C 411, ASTM C 795 and ASTM C 547,

- Type I and Type IV, with factory-applied ASJ+ -SSL+ or ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
3. Type II, 1200 degree F Materials: Mineral or glass fibers bonded with thermosetting resin. Comply with ASTM C547, Type II, Grade A, with Factory-applied ASJ+-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
 4. Maximum K-Factor: 0.23 at 75 deg. F mean temperature; 0.34 at 250 deg. F mean temperature.
- P. Glass Mineral Wool Pipe and Tank Insulation: Glass mineral wool bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ Max, ASJ+, or PSK complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
1. Products:
 - a. Certain Teed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation, with Ecose® Technology.
 - d. Knauf Insulation; Kwik-Flex pipe and tank insulation with Ecose® Technology.
 - e. Owens Corning; Fiberglas® Pipe and Tank Insulation with white ASJ Max poly encapsulated facing for systems operating at temperatures to 650°.
 2. Maximum K-Factor: 0.29 at 100 deg. F mean temperature; 0.45 at 300 deg. F mean temperature.
 3. Minimum Density: 2.5 pounds per cubic foot.
- Q. Polyurethane Foam Board Insulation: Rigid CFC and HCFC free polyurethane insulation board, with glass fiber tissue top facing to provide a smooth, firm surface suited for mechanically fastened and adhered membrane applications.
1. Products:
 - a. Sarnafil Sarna-therm.
 2. Compressive strength shall exceed 3000 pounds per square foot.
 3. Maximum K-factor: 0.18 at 75 deg. F.
 4. Field-Applied Jacket: Requirements are specified in Part 2 "Field-Applied Jackets."

2.3 FIRE RATED INSULATION KITCHEN HOOD/EQUIPMENT FLUE EXHAUST SYSTEMS

- A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C656, Type II, Grade 6. UL tested and certified to provide a 2-hour fire rating.
1. Products:
 - a. 11G Super Firetemp M.
- B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is UL tested and certified to provide a 2-hour fire rating.

1. Products:
 - a. CertainTeed Corp.; FlameChek.
 - b. Ceramics Firemaster Wrap.
 - c. 3M; Fire Master Wrap Products.

2.4 INSULATING CEMENTS

- A. Comply with VOC limits specified in Division 01 Section "Volatile Organic Compound (VOC) Content Restrictions."
- B. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- C. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
- D. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.5 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 and Polyisocyanurate Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 81-84.
 - b. Pittsburg Corning, PC 99 2k Adhesive.

- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II Class I.

1. Products:
 - a. Armacell LCC; Armaflex 520 Adhesive, Armaflex 520 BLV Low-VOC Adhesive....
 - b. Foster Products Corporation, H. B. Fuller Company; 85-60.

- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 85-70.
 - b. Eagle Bridges - Marathon Industries, Inc.; 225.

- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products:

- a. Foster Products Corporation, H. B. Fuller Company; 85-70.
 - b. Eagle Bridges - Marathon Industries, Inc.; 225.
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
- G. Polyurethane Foam Insulation Board: Manufacturer's recommended synthetic adhesive compatible with polyurethane insulation.
 - 1. Products:
 - a. Sarnafil Sarnacol 2170 or Sarnacol 21425.

2.6 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Comply with VOC limits specified in Division 01 Section "Volatile Organic Compound (VOC) Content Restrictions."
- C. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - b. Eagle Bridges - Marathon Industries, Inc.; 590.
 - c. Mon-Eco Industries, Inc.; 55-40.
 - d. Pittsburg Corning, PITTCOTE 404 Coating.
 - e. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
 - 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 35-00.
 - b. Eagle Bridges - Marathon Industries, Inc.; 550.
 - c. Mon-Eco Industries, Inc.; 55-50.
 - d. Vimasco Corporation; WC-1/WC-5.
 - 2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 200 deg F.

4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.7 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 1. Comply with VOC limits specified in Division 01 Section "Volatile Organic Compound (VOC) Content Restrictions."
 2. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 81-42W.
 - b. Eagle Bridges - Marathon Industries, Inc.; 130.
 - c. Vimasco Corporation; 713/714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation.
 4. Service Temperature Range: Minus 50 to plus 180 deg F.
 5. Color: White.

2.8 SEALANTS

- A. Comply with VOC limits specified in Division 01 Section "Volatile Organic Compound (VOC) Content Restrictions."
- B. Joint Sealants:
 1. Joint Sealants for Cellular-Glass and Polyisocyanurate Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 30-45.
 - b. Eagle Bridges - Marathon Industries, Inc.; 405.
 - c. Mon-Eco Industries, Inc.; 44-05.
 - d. Pittsburgh Corning Corporation; PITTSEAL® 444Ns Sealant.
 - e. Pittsburgh Corning Corporation: PITTSEAL® CW Sealant.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Permanently flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 5. Color: White or gray.
- C. FSK and Metal Jacket Flashing Sealants:
 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - b. Eagle Bridges - Marathon Industries, Inc.; 405.
 - c. Mon-Eco Industries, Inc.; 44-05.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Fire- and water-resistant, flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: Aluminum.

D. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.9 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+ -SSL+; ASK+ jacket with Self-Sealing Advanced Closure system; complying with ASTM C 1136 Type I, II, III, IV and VII secured with self-sealing longitudinal laps and matching ASK+ butt strips.
2. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with a polypropylene outer film layer.
3. ASJ Max: All service jacket made using aluminum foil and tri-directional reinforcing scrim bonded to Kraft paper with polypropylene outer layer complying with ASTM C 1136, Type I.
4. Redi-Klad Jacket: Factory applied Venture Clad 5-ply weather ad abuse resistant with self-sealing lap. Zero permeability per ASTM E 96-05; puncture resistance 35.4 kg (189.3 N) per ASTM D 1000; tear strength 4.3 lb (19.4 N) per ASTM D 624; thickness 14.5 mils (0.0145"); tensile strength 68 lb/inch width [306 N (32 kg)/25 mm].
5. FSK (FRK) Jacket: Aluminum-foil, fiberglass-reinforced scrim with Kraft-paper backing; complying with ASTM C 1136, Type II.
6. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
7. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
8. PVDC Jacket for Indoor Applications: 4-mil thick, white PVDC bioxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
9. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
 - 2) HiCube Coating: HC1000 Vapor Barrier
10. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.
11. PSK Jacket, Polypropylene scrim with Kraft.

12. Aluminum-Polyester Self-Adhesive Jacket: 12 mils thick, made with alternating layers of aluminum foil and polyester film coated with cold weather acrylic adhesive. Construction of laminate designed to provide UV resistance, high puncture and tear resistance.
 - a. Products:
 - 1) Armacell LLC; ArmaTuff

2.10 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Comply with VOC limits specified in Division 01 Section "Volatile Organic Compound (VOC) Content Restrictions."
- B. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.
 1. Products:
 - a. Vimasco Corporation; Elastafab 894.
- C. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.
- D. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.
 1. Products:
 - a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.
 - c. Pittsburgh Corning Corporation; PC Fabric 79.

2.11 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Comply with VOC limits specified in Division 01 Section "Volatile Organic Compound (VOC) Content Restriction."
- C. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with Kraft-paper backing.
- D. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; 30 mil thickness; roll stock Ready for shop or field cutting and forming.
 1. Products:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: white
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps and mechanical joints minimum 30 mil thickness.
5. Factory-fabricated tank heads and tank side panels.
6. Provide preformed Fiberglass 1 lb. density 2" thick insulation inserts to comply with ASHRAE 90.1 and ASTM C547 requirements.

E. Metal Jacket:

1. Products:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, and Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Thickness:
 - 1) Up to 24 inch diameter, width, or height: 0.016 inch minimum.
 - 2) 25 inch to 59 inch diameter, width, or height: 0.024 inch minimum.
 - 3) 60 inch and larger diameter, width, or height: 0.032 inch minimum.
 - c. Finish: Smooth finish.
 - d. Color: White
 - e. Moisture Retarder: 3-mil- thick Polysurlyn (co-extrusion of polyethylene and Dupont Surlyn®, heat laminated to the metal jacketing).
 - f. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and longradius 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.
3. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M
 - a. Sheet and roll stock ready for shop or field sizing.
 - b. Thickness: 0.016 inch minimum.
 - c. Finish: 3/16" corrugations with dull finish.
 - d. Moisture Retarder: 3-mil- thick Polysurlyn (co-extrusion of polyethylene and Dupont Surlyn®, heat laminated to the metal jacketing).
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) 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.
- F. 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.
 1. Products:
 - a. Pittsburgh Corning Corporation; PITTWRAP® HS Jacketing.
 - b. Polyguard; Insulrap No Torch 125.
- G. 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.
 1. Products:
 - a. Polyguard; Alumaguard 60.
 - b. MFM Building Products Corp., Flex Clad 400.
 - c. Venture Clad Jacketing.
 - d. HiCube Coating Jacketing
- H. Rubber Membrane: 48-mil thick membrane consisting of a glass fiber carrier coated on both sides with liquid PVC-P Plastisol, and laminated to polyester fleece.
- I. Pipe Sound Lagging: Loaded vinyl with fibrous glass scrim reinforced aluminum foil facing over 2-inch thick quilted fiberglass decoupler. Loaded vinyl shall be 2 psf minimum surface weight. Glass fiber pipe wrap shall be semi-rigid, preformed type, 2- inch minimum thickness, 1-1/2 pcf density.
 1. Manufacturers:
 - a. Kinetics.
 - b. Sound Seal.
 2. Sound Transmission Class (STC) Rating: 26.
- J. Duct Sound Lagging: Reinforced, loaded vinyl noise barrier.
 1. Products:
 - a. Kinetics; KNM-100 AL
 - b. Sound seal; B-10R
 - c. Unger Technologies, Inc.; Model DL-10-LAG
 2. Sound Transmission Class (STC) rating: 26.
 3. Density: 1 pound per square foot.

K. Refrigerant Piping Insulation Covering for Outdoor Installations.

1. An insulation protective cover shall be provided and installed to be flexible, U/V and weather resistant. The PVC plastic pipe insulation cover as manufactured by AIREX E FLEXGUARD or comparable acceptable product, and shall feature an integrated, outdoor-rated durability, industrial-grade, full-enclosure fastening system that is double secured by molecular bonding, allowing custom, cut-to-length installations. The cut-to-length installations shall comprise of a non-unraveling PVC cover material that does not compromise long-term-effectiveness or require specialized tools and cutting equipment. The engineered fastening system shall allow the cover to be removable and reusable for maintenance without the use of adhesives as an attachment in any shape or form, including either in the protector's construction, installation, or attachment to pipe insulation, as this will negatively affect insulation permeance performance and promote insulation material degradation which causes added energy usage by equipment. WRAPPING TAPE OR ADHESIVE TAPE SHALL NOT BE PERMITTED AS PER ENERGY CODES. Insulation Protector shall be tested and meet the following testing: ASTM E 96 (Vapor Transmission of Materials), ASTM G 153 (Carbon Arc Light Exposure – Accelerated Weathering), ASTM D 412 (Tensile Strength after UV Exposure and Water Immersion), ASTM 570 (Water Absorption of Plastics), ASTM E 84/UL 723 (Surface Burning Characteristics of Building Materials, ASTM G 21 (Fungal Growth). UV/Protector Pipe Insulation Material shall meet Class II vapor retarder per ASTM E 96 (vapor/moisture permeability test) "1 perm or less". THE USE OF U/V PAINT OR NON-PERMEABLE MATERIALS OR ADHESIVES ARE NOT PERMITTED FOR THIS APPLICATION.

2.12 TAPES

- A. Comply with VOC limits specified in Division 01 Section "Volatile Organic Compound (VOC) Content Restrictions."
- B. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
 1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - e. HiCube Coating: HC108
 2. Width: 3 inches.
 3. Thickness: 11.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- C. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.

1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - e. HiCube Coating: HC106
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- D. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 - e. HiCube Coating: HC404
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- E. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
1. Products:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - e. HiCube Coating: HC100
 2. Width: 2 inches.
 3. Thickness: 3.7 mils.
 4. Adhesion: 100 ounces force/inch in width.
 5. Elongation: 5 percent.
 6. Tensile Strength: 34 lbf/inch in width.
- F. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing, EPA approved anti-microbial additive.
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. Armacell LLC; AP/Armaflex Insulation Tape
- b. Approved Equal

2.13 SECUREMENTS

A. Bands:

- 1. Products:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
- 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.
- 5. Tape:
 - a. 3M: Scotch Brand #880

B. Insulation Pins and Hangers:

- 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
- 2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
- 3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.

- 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low carbon steel, fully annealed, 0.106- inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - 5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inchthick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
 - 6. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Manufacturers:
 - 1) GEMCO.
 - 2) Midwest Fasteners, Inc.
 - 7. Insulation Pipe Hanger Supports: Support piping system using high-density inserts with sufficient compressive strength, embedded within flexible elastomeric foam, with thickness equal to or greater than the pipe insulation.
 - a. Products: subject to compliance with requirements, available products that may be incorporated into the work include, but not limited to, the following:
 - 1) Armacell LLC; Armafix IPH
 - 2) Approved Equal
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers:

- a. ACS Industries, Inc.
- b. C & F Wire.
- c. Childers Products.
- d. PABCO Metals Corporation.
- e. RPR Products, Inc.

2.14 CORNER ANGLES

- A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.
- B. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or 316.

2.15 DUCT SOUND LINING (Refer to Division 23 Section: "HVAC Air Distribution.")

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements." Coordination and project conditions.
- B. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- C. Verify surfaces are clean and dry, with foreign material removed.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that applies 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 COMMON INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Install insulation continuously through hangers and around anchor attachments.
- K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at anchors and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with self-sealing factory-applied jackets as follows:
 - 1. Locate all longitudinal pipe insulation jacketing laps in least visible location.
 - 2. Draw jacket tight and smooth.
 - 3. For proper sealing, seal lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool.

4. Vapor seal all circumferential joints with factory furnished matching pressure sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool.
- N. Install insulation with non-self-sealing 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 selfsealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- O. Cut and install insulation in a manner to avoid compressing insulation more than 25 percent of its original nominal thickness.
- P. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- Q. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- R. Replace insulation on existing piping, and equipment where indicated on the drawings. Match insulation type and thickness indicated by the insulation schedule at the end of this section.
- S. Replace insulation on new and existing piping, and equipment where insulation is damaged during construction or removed for testing and balancing work.
- T. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
 2. Testing agency labels and stamps.
 3. Nameplates and data plates.
 4. Manholes.
 5. Handholes.
 6. Cleanouts.
 7. Unions.
 8. Heating water strainers (1-inch and less).
 9. Flanges.
 10. Expansion joints.
 11. Heating water valves (1-inch and less).
- U. Duct and plenum liner application: Refer to Division 23 Section: "HVAC Air Distribution."

- V. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- W. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size insulation large enough to enclose pipe and heat trace. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water.
- X. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- Y. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.
- Z. Insulate chilled water valves and strainers with closed cell insulation.

3.4 BUILDING 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 Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- F. Insulation Installation at Floor Penetrations:
 - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Pipe: Install insulation continuously through floor penetrations.

3.5 DUCT AND PLENUM INSULATION INSTALLATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.
 - 1. Install either capacitor discharge weld pins and speed washers or cupped head, capacitor discharge weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches oc.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches oc. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation; maximum 25 percent compression.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - g. Pressure sensitive foil tapes shall be a minimum 3" wide and shall be applied with moving pressure using a squeegee or other appropriate sealing tool.
 - 2. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with ½ inch outward clinching staples, 1 inch oc. Install vapor barrier consisting of vapor barrier acrylic based tape; matching the facing, or factory or field-applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions. Follow NAIMA's "Guide to insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation" for additional details when installing Pipe and Tank Insulation.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg. F at 18 foot intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped

- pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
- c. Where vapor retarder performance is required, all penetrations and damage to the facing shall be repaired using pressure sensitive foil tape or mastic prior to system startup.
 - d. Pressure sensitive foil tapes shall be a minimum 3" wide and shall be applied with moving pressure using a squeegee or other appropriate sealing tool.
3. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches oc.
 4. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat oval duct elbows with individually mitered gores cut to fit the elbow.
 5. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6 inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches oc.
- B. Board Insulation Installation on Ducts and Plenums: Secure with insulation pins.
1. Install either capacitor discharge weld pins and speed washers or cupped head, capacitor discharge weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. Apply insulation with joints butted as close as possible to the duct surface.
 - b. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches oc.
 - c. On duct sides with dimensions larger than 18 inches, space pins 16 inches oc. Each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - d. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - e. Do not over compress insulation during installation.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - g. All joints shall be sealed using minimum 3 inch wide pressure sensitive, acrylic based tape; matching the facing. Tape shall be firmly rubbed; using a plastic squeegee or sealing tool to assure complete bond.
 2. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Install vapor barrier consisting of vapor barrier acrylic based tape; matching the facing, or factory or field applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18 foot intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

- c. All joints shall be sealed using minimum 3 inch wide pressure sensitive, acrylic based vapor barrier tape; matching the facing. Tape shall be firmly rubbed; using a plastic squeegee or sealing tool to assure complete bond.
3. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat oval duct elbows with individually mitered gores cut to fit the elbow.
4. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6 inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches oc.

(The use of adhesive to secure insulation to ductwork is not advised. It MAY affect the FHC of the insulation. It also adversely affects the installation; particularly of Duct Wrap because the insulation is more difficult to position on the ductwork; especially in tight spaces.)

3.6 MECHANICAL PIPE EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Rigid and Semi-Rigid Insulation: Secure insulation with anchor pins and speed washers. Insulation for tanks and vessels should only be applied using weld pins or self-adhesive pins (depending on the circumstances) and speed washers. Adhesive should not be used to secure insulation to the tanks or vessels, unless flexible elastomeric insulation is utilized.
 1. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 2. Protect exposed corners with secured corner angles.
 3. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 5. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around

outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

6. Stagger joints between insulation layers at least 3 inches.
7. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
8. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
9. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. PIPE & TANK INSULATION AND KWIKFLEX

1. Apply on clean, dry surfaces.
2. Cut to appropriate length using manufacturers' stretch out guide for the specific pipe size. Add an additional 2 inches to 4 inches for a staple flap.
3. Install insulation around the equipment and pipe circumference in a manner that ensures a firm fiber mesh at all joints. Fasten the longitudinal with outward clinching staples placed 3 inches on center. As an alternative, individual sections may be fastened in place using continuous and overlapping strands of 3/4" wide glass fiber filament tape around the insulation jacketing O.D. Longitudinal and circumferential joints shall be sealed with 4" wide matching pressure sensitive tape squeegeed along the entire length.
4. For equipment and pipe exposed to the elements, jacketing shall be 0.016 inches thick aluminum with factory applied moisture barrier or 0.010 inches thick stainless steel with a factory applied moisture barrier or laminated self-adhesive water and weather seals. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2" overlap joint. For systems operating below ambient, all joints shall be sealed completely along the longitudinal and circumferential seams and installed so as to shed water. All circumferential joints shall be sealed by use of preformed butt strips; minimum 2" wide or a minimum 2" overlap. Butt strips shall overlap the adjacent jacketing a minimum 1/2 inch and be completely weather sealed. For systems operating above ambient, circumferential joints should overlap a minimum of 2" and not be sealed. Insulation thickness for duct covered by Jacketing shall be such that the surface temperature of the does not exceed 125°F.
5. On below ambient straight duct, vapor retarder mastic shall be applied to raw glass fiber ends at 12 foot to 21 foot intervals and on either side of fittings, flanges or valves before taping. Mastic shall extend a minimum of 2 inches onto the bore of the pipe and 2 inches onto the jacketing.

C. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
2. Seal longitudinal seams and end joints.

D. Insulation Installation on Pumps:

1. Fabricate removable, re-useable metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Covers for split case pumps

- shall be constructed with insulated housing in two sections with upper section removable for access to casing. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8- inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum or stainless steel, at least 0.050 inch thick.
 3. For below ambient services (chilled water, chilled glycol, ground source heat pump, etc.), install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.7 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 2. Fittings shall be insulated to same thickness as the adjoining insulation. Apply fittings per fitting manufacturer's instructions. When required by specification, a hard insert of sufficient length shall be utilized to avoid compression of the insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word UNION." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.8 GLASS MINERAL WOOL INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes.
 1. Secure pipe insulation to pipe using self-sealing lap system.
 2. On high temperature piping, above 500° F apply insulation using double layer and staggered joints. For double layer installation, secure theunjacketed inner layer using filament tape; without deforming insulation material. All joints and ends must be firmly butted and secured with appropriate securing material.
 3. Firmly rub all longitudinal and circumferential joints using a squeegee or sealing tool.
 4. Longitudinal jacket laps for pipe insulation installed on piping systems with operating temperatures below ambient shall be vapor sealed with factory-applied pressure-sensitive adhesive vapor retarder, self-sealing lap. For proper sealing, firmly rub lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool. Vapor seal all circumferential joints with factory-furnished, matching pressure-sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool. Additionally, coat raw edges of pipe insulation sections with vapor retarder mastic at 12 foot to 21 foot intervals and on either side of all fittings, flanges, or valves. Vapor retarder mastic shall completely coat the ends of the pipe and extend onto the bore of the pipe insulation and onto the jacketing a minimum of 2 inches. Follow NAIMA's "Guide to

Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation" for additional details.

5. Install metal shields between hangers or supports and the pipe insulation. Install rigid insulation inserts as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation, and shall be vapor sealed as required. Insulation shields shall be no less than the following lengths:
 - a. 1-1/2 inch to 2-1/2 inch IPS: 10 inch long.
 - b. 3 inch to 6 inch IPS: 12 inch long.
 - c. 8 inch to 10 inch IPS: 16 inch long.
 - d. 12 inch and over IPS: 22 inch.
6. For piping subject to abuse in mechanical rooms or high traffic areas, protect insulation from mechanical abuse by the use of appropriate thickness of PVC jacketing, metal jacketing, or laminated self-adhesive water and weather seal.
7. For piping exposed to the elements, install Redi-Klad Pipe Insulation with 4 inch butt strips and self-sealing lap, a jacket that shall be a minimum 0.016 inch thick aluminum jacket with factory-applied moisture barrier, or a minimum 0.010 inch thick stainless steel jacket with factory-applied moisture barrier. Fittings shall be of similar materials. Apply all jacketing per manufacturer's recommendations for the conditions.
8. For piping operating below ambient temperature or in high abuse areas, install Redi-Klad Pipe Insulation with 4 inch butt strips and self-sealing lap. Follow the same guide lines when using Redi-Klad as indicated for ASJ+-SSL+ above.

B. Insulation Installation for 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 Glass Mineral Wool 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 formaldehyde free Glass Mineral Wool fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed formaldehyde free fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to 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 CELLULAR-GLASS INSULATION INSTALLATION

- A. A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with tape 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 below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellulglass block insulation of same thickness as 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 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 tape 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.

3.10 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Insulation Installation on Ductwork:

1. Cut to bottom piece first, making it the same width as the duct. Then cut the two side pieces, so that they extend down over the edges of the bottom insulation; keep top edges flush with the top of the duct. The top insulation should be sized so that it extends over the side insulations.
2. Cut elastomeric insulation pieces cleanly using a sharp knife and a straightedge.
3. Apply manufacturers recommended adhesive. First brush- or roller-coat adhesive on the metal duct surface. Then coat the back side of the insulation sheet, leaving a 1/2"-wide uncoated border at butt-edge seams. Allow the adhesive to dry to the touch but still tacky under slight pressure before joining surfaces.
4. Position the sheet so that it overlaps the edges of previously installed sheet or sheets by 1/8". Hold the sheet in this position, and spot-adhere it in the center. Compress the butt edges into place for a tight joint with adjoining sheets. Then bond the remainder of the sheet by pressing it firmly into place. Use a small hand roller to apply pressure.
5. Spread the joint, and with a small brush, apply adhesive to both butt edges. Do not flood joint with adhesive. Align carefully for good appearance, and apply pressure to joint.
6. Insulate standing seams with strips of elastomeric insulation sheet.
7. Refer to Part 3 Section "Field-Applied Jacket Installation" for jacket installation requirements.

3.11 ROCK MINERAL WOOL INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials, unless ASJ SSL jacketing is being used.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

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

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

E. Blanket Insulation Installation on Ducts and Plenums: Secure with insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

- d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2- inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. (10 deg C) at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- F. Board Insulation Installation on Ducts and Plenums: Secure with insulation pins.
- 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure

laps to adjacent insulation section with 1/2- inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.12 POLYURETHANE BOARD INSULATION INSTALLATION

A. A. Insulation Installation on Outdoor Ductwork.

1. Ensure the substrate is solvent resistant, dry and free from oil and grease. Use manufacturer's recommended cleaning solution.
2. Adhere the polyurethane insulation boards to the ductwork using the manufacturer's recommended adhesive. Cut insulation board for bottom of duct so that it is the same width as the exterior duct width. Cut insulation for sides of the duct such that it starts flush with the top of the duct and overlaps the insulation on the bottom of the duct. Cut the insulation for the top of the duct such that it overlaps the insulation on each side of the duct. Provide multiple layers of insulation board as required to ensure that the specified insulation thickness is maintained over all flanges. Install insulation boards such that joints are staggered.
3. Apply aluminum tape at all joints.

3.13 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
 2. For exterior refrigerant piping utilize PVC plastic pipe insulation cover, cut-to-length full enclosure fastening system. NO ADHESIVE TAPE OR WRAPPING TAPE SHALL BE PERMITTED PER ENERGY CODE.
- 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.
1. Where rubber membrane jackets are indicated, install the membrane using the manufacturer's recommended adhesive. Before use thoroughly stir the adhesive. Replace the container lid when work is interrupted. If required thin the adhesive as recommended by the manufacturer.
 2. Using a sheepskin or similar roller apply a primer coat of adhesive to the roof surface, priming only the area of roof where the membrane will be laid the same day. Allow adhesive to dry.
 3. Unroll the membrane and fold back approximately half its length.
 4. Apply adhesive with a sheepskin or similar roller to the underside of the membrane ensuring the weld area is kept free of adhesive and allow to touch dry.
 5. Carefully roll out the membrane over the previously primed surface and roll with water filled roller.
 6. Fold back other half of the roll of membrane and repeat the procedure.
 7. Unroll the next roll of membrane, ensuring the end laps are staggered and the side overlaps the previously installed sheet by 2 inches.
 8. Repeat the adhering process.
 9. Fully hot air weld the 2-inch side lap, allow to cool completely.
 10. Mechanically check the integrity of the cooled weld by running a 3/16-inch wide screwdriver (with rounded edges) along the seam applying pressure into the seam.
 11. Install Peel Stop and PVC Welding Cord at all perimeters, penetrations and changes of roof direction.
- E. Pipe Sound Lagging:
1. Seal and fasten in accordance with manufacturer's written instructions to maintain specified STC rating.
 2. Cover entire pipe with glass fiber wrap. Fill all voids with clean glass fiber scrap. Apply over this wrap an airtight cover of loaded vinyl. Do not connect the cover rigidly to pipe or hangers. Overlap longitudinal seams in loaded vinyl 2-inch minimum and tape with cloth-backed tape. Overlap edge seams 1-inch minimum and tape with cloth-backed tape or with acoustical sealant. Extend ends of cover within 1/2-inch of penetration through wall,

- ceiling, and/or floor. Seal annular gap between pipe lagging and penetration airtight with acoustic sealant.
3. Duct lagging shall be independently supported gypsum board with batt insulation.

3.14 FINISHES

- A. Finish Duct, Equipment, and Pipe Insulation with ASJ, Glass Cloth, or Other Paintable Jacket Material. Clad-Type Jacketing such as Venture RediKlad or Venture Clad may be utilized.
- 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.

3.15 INSULATION APPLICATION SCHEDULE

- A. Acceptable insulation materials, thickness and vapor retarder requirements are identified for each application and size range. If more than one material is listed for an application and size range, selection from the materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Fire-suppression piping.
 2. Drainage piping located in crawl spaces.
 3. Below-grade piping.
 4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.
 5. Exhaust ductwork
 6. Factory-insulated flexible ducts.
 7. Factory-insulated plenums and casings.
 8. Flexible connectors.
 9. Vibration-control devices.
 10. Factory-insulated access panels and doors.
- C. All supply and outside air ductwork with internal sound lining shall be externally insulated.
- D. Where metal ducts are specified to have internal duct liner, the thickness of the external insulation may be reduced by one inch, except minimum duct external insulation thickness shall be 1 inch.

3.16 HVAC PIPING INSULATION APPLICATION SCHEDULE:

1. Unconditioned spaces include locations where summer temperature and humidity conditions are similar to outdoor conditions (such as mechanical rooms ventilated with unconditioned outdoor air, parking garages, pedestrian tunnels, etc.). Pipes in these spaces to be insulated similar to outdoor requirements.
2. Where rigid pipe insulation (cellular glass, etc.) is scheduled, provide mineral fiber through and 6 inches beyond pipe sleeves, to allow for pipe expansion.

Miscellaneous (all supply and return)	Type of Insulation Material	Vapor Retarder Required	Pipe Size	Insulation Thickness Required
Air conditioning condensate drain, equipment drain, and non-steam humidifier drain	Flexible Elastomeric	No	<1"	0.5"
			1" to <8"	1"
			≥8"	1.5"
Refrigerant pipe	Flexible Elastomeric	No	All	1"

3.17 HVAC DUCTWORK INSULATION APPLICATION SCHEDULE

1. Unconditioned spaces include locations where summer temperature and humidity conditions are similar to outdoor conditions (such as mechanical rooms ventilated with unconditioned outdoor air, parking garages, pedestrian tunnels, etc.)
2. Top of ductwork located outdoors shall be provided with polyurethane board insulation of equal thickness to sides and bottoms. Taper insulation to shed water, minimum ¼" per foot slope, with insulation thickness at low edges equal to scheduled insulation thickness.
3. All diffuser cones, air valves, damper boxes, HVAC equipment, coils, coil headers, casings, plenums, air measuring devices, chilled beams, etc. shall be insulated.

Supply air ductwork, plenums, and accessories	Type of Insulation Material	Vapor Retarder Required	Insulation Thickness Required
Concealed (Indoor)	Glass Mineral Wool Blanket	Yes	1.5"
Exposed (Indoor)	Glass Mineral Wool Board	Yes	1.5"
Attic and unconditioned spaces (Indoor)	Glass Mineral Wool Board	Yes	2"

Return and transfer air ductwork, plenums, and accessories	Type of Insulation Material	Vapor Retarder Required	Insulation Thickness Required
In locations other than attics and unconditioned spaces (Indoor)	None	No	

Attic and unconditioned spaces (Indoor)	Glass Mineral Wool Board	Yes	2"

Outdoor air ductwork, plenums, and accessories	Type of Insulation Material	Vapor Retarder Required	Insulation Thickness Required
Concealed (Indoor)	Glass Mineral Wool Blanket	Yes	1.5"
Exposed (Indoor)	Glass Mineral Wool Board	Yes	2"
Attic and unconditioned spaces (Indoor)	Glass Mineral Wool Board	Yes	2"

FIELD APPLIED JACKET APPLICATION SCHEDULE

SERVICE	FIELD APPLIED JACKET TYPE
Indoor concealed piping	None
Outdoor exposed piping	Aluminum
Indoor, exposed insulated ductwork within 12 feet of floor	Woven Glass Fiber Fabric
Indoor, exposed insulated ductwork greater than 12 feet of floor	None
Indoor, concealed insulated ductwork	None
Indoor, exposed insulated ductwork	Aluminum or Self-Adhesive Outdoor Jacket
Outdoor, exposed insulated ductwork	Aluminum or Self-Adhesive Outdoor Jacket
Outdoor, underground insulated piping	Underground Direct Buried Jacket
Equipment, generally (Refer to Notes 1 & 2)	Woven Glass Fiber Fabric
Equipment, Cold surface (Refer to Notes 1 & 2)	PVC

Jacket Application Schedule Notes:

4. Refer to Part 3 specification section titled "Mechanical Equipment, Tank, and Vessel Insulation Installation" for requirements for revocable, re-usable metal boxes lined with insulation at pumps.
5. Including factory insulated equipment without factory applied jacket.
6. If ductwork or piping indicated to have sound lagging also requires an additional field jacket, install sound lagging between insulation and additional field jacket.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other Sections of Division 23.

1.2 SUMMARY

- A. Section includes:
 - 1. Pipes, tubing, fittings, and specialties.
 - 2. Special duty valves.
 - 3. Refrigerants.
 - 4. Installation of refrigerant piping.
 - 5. Engineered Wall Seal and Insulation Protection System.
- B. Products installed but not furnished under this Section include pre-charged tubing, refrigerant specialties, and refrigerant accessories furnished as an integral part of packaged air conditioning equipment.
- C. Design and installation shall be provided in accordance with equipment manufacturer's recommendations.
- D. Related Sections: The following sections contain requirements that relate to this section:
 - 1. Division 07 Section: "Joint Sealants" For materials and methods for sealing penetrations through walls.
 - 2. Division 08 Section: "Access Doors and Frames": Access Doors for concealed valves and accessories
 - 3. Division 09 Section: "Painting and Coating": Product requirements for painting for placement by this section.
 - 4. Division 23 Section: "Common Work Results for HVAC": Labeling and identification of refrigerant piping.
 - 5. Division 23 - HVAC Insulation: Product requirements for Piping Insulation for placement by this section.
 - 6. Section: "HVAC Insulation": Pipe insulation.
 - 7. Division 23 Section: "Vibration and Seismic Controls for HVAC Piping and Equipment." Product requirements for Vibration Isolation for placement by this section.
 - 8. Division 26 Section: "Raceways and Boxes for Electrical Systems": Requirements of conduits and boxes housing electrical connections specified by the section.

REFRIGERANT PIPING

1.3 REFERENCES

- A. Air-Conditioning and Refrigeration Institute:
 - 1. ARI 495 - Refrigerant Liquid Receivers.
 - 2. ARI 710 - Liquid-Line Driers.
 - 3. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter Dryers.
 - 4. ARI 750 - Thermostatic Refrigerant Expansion Valves.
 - 5. ARI 760 - Solenoid Valves for Use with Volatile Refrigerants.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. American Society of Mechanical Engineers:
 - 1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 - 3. ASME B31.5 - Refrigeration Piping.
 - 4. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- D. ASTM International:
 - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - 3. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
 - 4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
 - 5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
 - 6. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
- E. American Welding Society:
 - 1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
 - 2. AWS D1.1 - Structural Welding Code - Steel.
- F. Manufacturers Standardization Society of the Valve and Fittings Industry:
 - 1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
 - 2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
 - 3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- G. Underwriters Laboratories Inc.:
 - 1. UL 429 - Electrically Operated Valves.

1.4 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.
- C. Provide pipe hangers and supports in accordance with ASME B31.5, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.
- D. Flexible Connectors: Use at or near compressors where piping configuration does not absorb vibration.

1.5 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Product data for the following products:
 - 1. Each type valve specified.
 - 2. Each type refrigerant piping specialty specified.
- C. Submit Shop Drawings showing:
 - 1. The design and layout of refrigerant piping, valves, expansion valves, heat recovery boxes, branch selector boxes, drains, accumulators, traps, hot gas bypass, filters, and miscellaneous specialties, etc.
 - 2. Pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details.
 - 3. Interface and spatial relationship between piping and proximate to equipment.
- D. Provide a letter from the equipment manufacturer certifying the refrigerant pipe layout indicated on the refrigerant pipe shop drawing is being provided in accordance with the equipment manufacturer's criteria including layout, pipe length, pipe offsets, and pipe size.
- E. Brazer's Certificates signed by Contractor certifying that Brazer's comply with requirements specified under "Quality Assurance" below.
- F. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating and Maintenance Manual specified in Division 01 and in Division 23 Section: "Common Work Results for HVAC."
- G. Product Data:
 - 1. Piping: Submit data on pipe materials, fittings, and accessories.
 - 2. Valves: Submit manufacturers catalog information with valve data and ratings for each service.

3. Hangers and Supports: Submit manufacturers catalog information including load capacity.
4. Refrigerant Specialties: Submit manufacturers catalog information including capacity, component sizes, rough-in requirements, and service sizes for the following:
 - a. Refrigerant moisture and liquid indicators.
 - b. Refrigerant strainers.
 - c. Refrigerant pressure regulators.
 - d. Refrigerant pressure relief valves.
 - e. Refrigerant filter-driers.
 - f. Refrigerant solenoid valves.
 - g. Refrigerant expansion valves.
 - h. Electronic expansion valves.
- H. Design Data: Indicate pipe size. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- I. Test Reports: Indicate results of refrigerant leak test and piping system pressure test.
- J. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.
- K. Manufacturer's Certificate: Certify Products meet or exceed specified requirements
- L. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within previous 12 months.
- M. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements": Closeout procedures.
- B. Project Record Documents: Record actual locations of valves, equipment and refrigerant accessories.
- C. Operation and Maintenance Data: Submit instructions for installation and changing components, spare parts lists, exploded assembly views.

1.7 QUALITY ASSURANCE

- A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".
- B. Perform Work in accordance with authority having jurisdiction and AWS D1.1 for welding hanger and support attachments to building structure.
- C. Regulatory Requirements: Comply with provisions of the following codes:

1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping, latest edition.
2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration, latest edition.
3. International Mechanical and Plumbing Codes, latest edition.
4. PHCC: National Standard Plumbing Code, latest edition.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Fabricator or Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- C. Design piping system and hangers and supports under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Product storage and handling requirements.
- B. Dehydrate and charge refrigeration components including piping and receivers, seal prior to shipment. Maintain seal until connected into system.
- C. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.11 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section: "Product Requirements".
- B. Do not install underground piping when bedding is wet or frozen.

1.12 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.13 COORDINATION

- A. Division 01 Section: "Administrative Requirements": Requirements for coordination.
- B. Coordinate the installation of roof piping supports and roof penetration with Division 07.

1.14 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for valves excluding packing.

1.15 MAINTENANCE MATERIALS

- A. Division 01 Section: "Execution and Closeout Requirements": Spare parts and maintenance products.
- B. Furnish two refrigerant oil test kits each containing everything required for conducting one test.

1.16 EXTRA MATERIALS

- A. Division 01 Section: "Execution and Closeout Requirements": Spare parts and maintenance products.
- B. Furnish two packing kits for each size and valve type.
- C. Furnish two refrigerant filter-dryer cartridges of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Refrigerant Valves and Specialties:
 - a. Alco Controls Div, Emerson Electric.
 - b. Danfoss Electronics, Inc.
 - c. EATON Corporation, Control Div.
 - d. Henry Valve Company.
 - e. Parker-Hannifin Corporation, Refrigeration and Air Conditioning Division.
 - f. Sporlan Valve Company.

2.2 PIPE AND TUBING MATERIALS

- A. General: Refer to Part 3, Article "Pipe Application" for identification of systems where the below specified pipe and fitting materials are used.
- B. Drawn-Temper Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.
- C. Annealed-Temper Copper Tubing: ASTM B280, Type ACR
 - 1. Contractor Option: Pre-Insulated Line Sets
 - a. UL-Recognized
 - b. ASTM C-534 and ASTM E-84
 - c. Closed Cell Elastomeric
 - d. UV Resistant Rated Insulation

2.3 FITTING AND JOINING MATERIALS

- A. Fitting Materials
 - 1. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
- B. Joining Materials
 - 1. Brazing Filler for Joining Similar Metals: AWS A5.8, Classification BCuP series, with melting range from 1190 to 1480°F.
 - 2. Brazing Filler for Joining Dissimilar Metals: AWS A5.8, Classification BAg series, with melting range from 1125 to 1370°F.
- C. ACR Press Fittings – Contractor Option
 - 1. ACR fittings shall be refrigerant grade copper fitting suitable for brazing or mechanically sealed/pressed ACR fittings as manufactured by Conex Banninger.
 - 2. Fitting body shall consist of Refrigerant grade copper per ASTM-B8280 with internal NHBR sealing element. Mechanical press shall be of 3 point design. MaxiPro fittings shall incorporate hook lockingseal on top of fitting cup and pressed with Rothenberger approved press jaws. Fitting shall be supplied contaminant free in vapor sealed bags direct from factory. Fittings shall be marked with 48 bar or 700PSI and certified to UL-109, UL-207, and ASHRAE-15. Installing contractor shall be factory trained and owner shall receive 5 year warranty on all pressed connections. Proof of training shall be provided to owners rep at beginning of project.

2.4 VALVES

- A. Service shut-off valves shall be field-provided/installed for each branch to allow service to any indoor unit without field interruption to overall system operation.

- B. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.
- C. Ball Valves:
 - 1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals, soldered ends.
 - 2. Maximum working pressure: 700 psig
 - 3. Maximum working temperature: 325 degrees F
- D. Check Valves - Smaller Than 7/8 inch: 700 psig maximum operating pressure, 300 °F maximum operating temperature; cast brass body, with removable piston, Teflon seat, and stainless steel spring; straight through globe design. Valve shall be straight through pattern, with solder-end connections.
- E. Check Valves - 7/8 inch and Larger: 700 psig maximum operating pressure, 300°F maximum operating temperature; cast bronze body, with cast bronze or forged brass bolted bonnet; floating piston with mechanically retained Teflon seat disc. Valve shall be straight through or angle pattern, with solder-end connections.
- F. Solenoid Valves: ARI 760, 250°F temperature rating, 700 psig working pressure; forged brass, with Teflon valve seat, two-way straight through pattern, and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2 inch conduit adapter, and 24 volt, 60 Hz. normally closed holding coil.
- G. Evaporator Pressure Regulating Valves: pilot-operated, forged brass or cast bronze; complete with pilot operator, stainless steel bottom spring, pressure gage tappings, 24 volts DC, 50/60 Hz, standard coil; and wrought copper fittings for solder end connections.
- H. Thermal Expansion Valves: thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder end connections; complete with sensing bulb, a distributor having a side connection for hot gas bypass line, and an external equalizer line.
- I. Refrigerant Pressure Relief Valves: Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; for standard 700 psig setting; selected to ASHRAE 15.
- J. Hot Gas Bypass Valve: adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading; and wrought copper fittings for solder end connections.
- K. Electronic Expansion Valves
 - 1. Brass bodies with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
 - 2. Evaporation Control System: Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, pre-selection allowance for electrical defrost and hot gas bypass.
 - 3. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high

and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.5 REFRIGERANT PIPING SPECIALTIES

- A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.
- B. Strainers: 700 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.
- C. Moisture/liquid Indicators: 700 psig maximum operation pressure, 200°F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
- D. Filter-driers: ARI 710, 700 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:
 - 1. Standard capacity desiccant sieves to provide micronic filtration.
- E. Suction Line Filter-Drier: ARI 710, 700 psig maximum operation pressure, 225°F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant for removal of acids and moisture for refrigerant vapor.
- F. Suction Line Filters: 700 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter core kit, including gaskets, as follows:
- G. Flanged Unions: 700 psig maximum working pressure, 330°F maximum operating temperature; two brass tailpiece adapters for solder end connections to copper tubing; flanges for 7/8 inch through 1-5/8 inch unions shall be forged steel, and for 2-1/8 inch through 3-1/8 inch shall be ductile iron; four plated steel bolts, with silicon bronze nuts and fiber gasket. Flanges and bolts shall have factory-applied rust-resistant coating.
- H. Flexible Connectors: 700 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.
- I. Suction Accumulators: Provide as manufactured by Refrigeration Research, Inc.
- J. Refrigerant Receivers
 - 1. Internal Diameter 6 inch and Smaller: ARI 495, UL listed, steel, brazed; 700 psig pressure rating, with taps for inlet, outlet, and pressure relief valve.
 - 2. Internal Diameter 6 inch and Larger: ARI 495, welded steel, tested and stamped in accordance with ASME Section VIII; 700 psig with taps for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

2.6 REFRIGERANT:

- A. Type shall be provided to suit equipment being served.

2.7 LOCKING ACCESS PORT CAPS

- A. Provide locking cap(s) with multi-key(s) for all refrigerant circuit access ports located outdoors.
- B. Locking caps shall be as manufactured by Win Air Company or comparable acceptable product.

2.8 PROTECTIVE ENCLOSURES

- A. Provide 26 Gauge Steel with a 40-year Valspar Baked on Paint Finish.
- B. All metal construction, no plastic
- C. Tapering ends for easy joining pieces together
- D. Completely adjustable for exact length of coverage
- E. Basis of design PermaCover model HVAC Line Set Cover Kit – Metal Line. Comparable products shall be submittal for approval as a comparable product.

2.9 ENGINEERED WALL SEAL AND INSULATION PROTECTION SYSTEM:

- A. Provide a combined 2-in-1 protection system to be provided and installed for sealing wall penetrations of HVAC refrigerant line and protecting the refrigerant line set piping insulation. System basis of design shall be AIREX Pro-System Kit™ or a comparable acceptable product. The use of a combined sustainable compression gasket and seal system shall meet the requirements of the energy codes, to seal refrigerant line wall penetrations to prevent wall air-leakage, moisture intrusion, weather intrusion, rodent intrusion, vibration control, physical wall damage, when connecting with refrigerant piping or thermal insulated refrigerant piping.
- B. FLEXIBLE PVC PLASTIC COVERS: Provide Flexible PVC Plastic UV/Weather Protective Cover for Pipe Insulation. Basis of design shall be as manufactured by AIREX E-FLEX GUARD™ by Airex Manufacturing Inc. shall be provided and installed, the pipe insulation UV/protective cover shall feature an outdoor industrial grade combined method with molecular bonding and an integral pre-fastening system that allows removable/ reusable use for maintenance and full-enclosure including cut to length capabilities without the use of adhesives as an attachment in any way shape or form including either in the protectors construction or the protectors installation or on any attachment to pipe insulation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements": Coordination and project conditions.
- B. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation.
- C. Verify excavations are to required grade, dry, and not over excavated.

3.2 PREPARATION

- A. Pre-Cleaning:
 - 1. Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:
 - a. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing by means of a wire or an electrician's tape.
 - b. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
 - c. 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.
 - d. Finally, draw a clean, dry, lintless cloth through the tube or pipe.

3.3 INSTALLATION - INSERTS

- A. Provide inserts for placement in concrete forms.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. General: Hangers, supports, and anchors are specified in Division 23 Section: "Hangers and Supports for HVAC Piping and Equipment."

3.5 INSTALLATION OF VALVING

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.
- B. Install stop/ball valves:
 - 1. The suction inlet of each compressor, compressor unit, or condensing unit
 - 2. The discharge outlet of each compressor, compressor unit, or condensing unit
 - 3. Each inlet and each outlet of each condenser where more than one condenser is used in parallel.
 - 4. The inlet and outlet of each liquid receiver
 - 5. On each side of strainers and driers
 - 6. In liquid and suction lines at evaporators
 - 7. Elsewhere in accordance with manufacturer's instructions.
- C. Stop/ball valves shall be supported to prevent detrimental stress and strain on the refrigerant piping system.
- D. Stop/ball valves shall be identified where their intended purpose is not obvious.
- E. Install a full sized, 3-valve bypass around each drier.
- F. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at the top.
 - 1. Electrical wiring for solenoid valves is specified in Division 26. Coordinate electrical requirements and connections.
- G. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.
 - 1. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.
 - 2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.
 - 3. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.
 - 4. Where external equalizer lines are required, make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.
- H. Install pressure regulating and relieving valves as required by ASHRAE Standard 15.

3.6 PIPING APPLICATION

- A. Provide Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Provide Type K, annealed temper copper tubing for 2 inch and smaller without joints, within enclosed areas. Mechanical fittings (crimp or flair) are not permitted.
 - 1. Install annealed temper tubing in pipe duct. Vent pipe duct to the outside.

3.7 INSTALLATION OF PIPING

- A. Route piping parallel to building structure and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space.
- C. Group piping whenever practical at common elevations.
- D. Sleeve pipe passing through partitions, walls and floors.
- E. Install pipe identification
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide access where valves and fittings are not exposed.
- H. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
- I. Flood refrigerant piping system with nitrogen when brazing.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- K. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Insulate piping and equipment
- N. Provide replaceable cartridge filter-dryers, with isolation valves and bypass with valve.
- O. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.
- P. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.
- Q. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.
- R. Provide electrical connection to solenoid valves.
- S. Fully charge completed system with refrigerant after testing.
- T. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- U. Install refrigerant piping in accordance with ASME B31.5.

- V. Size piping and install refrigerant piping, traps, specialties as necessary for a complete and operational system in accordance with equipment manufacturer's recommendations.
- W. General: Install refrigerant piping in accordance with ASHRAE Standard 15 "The Safety Code for Mechanical Refrigeration". Unless specified otherwise by the Section, comply with "Installation of Piping - General" as specified in Division 22 Section; "Pipes and Tubes for Plumbing Piping and Equipment" and Division 23 Section: "Pipes and Tubes for HVAC Piping and Equipment."
- X. Install piping in as short and direct arrangement as possible to minimize pressure drop.
- Y. Install piping for minimum number of joints using as few elbows and other fitting as possible.
- Z. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.
- AA. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.
- BB. Insulate suction lines. Liquid lines are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.
 - 1. Do not install insulation until system testing has been completed and all leaks have been eliminated.
- CC. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.
- DD. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- EE. Slope refrigerant piping as follows:
 - 1. Install horizontal hot gas discharge piping with 1/2" per 10 feet downward slope away from the compressor.
 - 2. Install horizontal suction lines with 1/2" per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
 - 3. Install traps and double risers and where required in accordance with equipment manufacturer's recommendations to entrain oil in vertical runs.
 - 4. Liquid lines may be installed level.
- FF. Use fittings for all changes in direction and all branch connections.
- GG. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- HH. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

REFRIGERANT PIPING

- II. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- JJ. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- KK. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- LL. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.
- MM. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 07 for special sealers and materials.
- NN. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
- OO. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.
- PP. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.
 - 1. Install moisture/liquid indicators in lines larger than 2 1/8" OD, using a bypass line.
- QQ. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.
- RR. Install flexible connectors at the inlet and discharge connection of compressors.
- SS. Refrigerant circuit access ports located outdoors shall be fitted with locking-type-tamper-resistance caps.
- TT. Exposed refrigerant pipe in open spaces shall not be installed less than 7 feet 3 inches above the finished floor.
- UU. Refrigerant piping that penetrates two or more floor/ceiling assemblies shall be installed in a fire rated shaft enclosure.
- VV. Refrigerant piping located in concealed locations where tubing is installed in studs, joists, rafters, or similar member spaces, and located less than 1-1/2 inches from the nearest edge of the member shall be continuously protected by shield plates. Protective shield plates having a minimum thickness of 0.0575 inch (16 gage) shall cover the area of the pipe plus the area extending not less than 2 inches beyond both sides of the pipe.

REFRIGERANT PIPING

3.8 INSTALLATION - REFRIGERANT SPECIALTIES

- A. Refrigerant Liquid Indicators:
 - 1. Install line size liquid indicators in main liquid line downstream of condenser.
 - 2. When receiver is provided, install line size liquid indicators in liquid line downstream of receiver.
 - 3. Install line size liquid indicators downstream of liquid solenoid valves.
- B. Refrigerant Valves:
 - 1. Install service valves on compressor suction and discharge.
 - 2. Install gage taps at compressor inlet and outlet.
 - 3. Install gage taps at hot gas bypass regulators, inlet and outlet.
 - 4. Install check valves on compressor discharge.
 - 5. Install check valves on condenser liquid lines on multiple condenser systems.
 - 6. Install refrigerant charging valve in liquid line between receiver shut-off valve and expansion valve.
- C. Strainers:
 - 1. Install line size strainer upstream of each automatic valve.
 - 2. Where multiple expansion valves with integral strainers are used, install single main liquid-line strainer.
 - 3. On steel piping systems, install strainer in suction line.
 - 4. Install shut-off valves on each side of strainer.
- D. Install pressure relief valves on ASME receivers. Install relief valve discharge piping to terminate outdoors.
- E. Filter-Dryers:
 - 1. Install permanent filter-dryers in low temperature systems.
 - 2. Install permanent filter-dryer in systems containing hermetic compressors.
 - 3. Install replaceable cartridge filter-dryer vertically in liquid line adjacent to receivers.
 - 4. Install replaceable cartridge filter-dryer upstream of each solenoid valve.
- F. Solenoid Valves:
 - 1. Install in liquid line of systems operating with single pump-out or pump-down compressor control.
 - 2. Install in liquid line of single or multiple evaporator systems.
 - 3. Install in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.
- G. Refrigerant pipe enclosures:
 - 1. All refrigerant piping shall be protected by locating within building elements or protective enclosures
 - 2. Provide protective enclosures where piping is exposed within the building or outside on grade/roof.

3. Protective enclosures are not required:
 - a. Where piping is installed without ready access or located more than 7 feet 3 inches above the finished floor
 - b. Where located within 6 feet of the refrigerant unit or appliance
 - c. Where located in a machinery room per IMC 1105.

3.9 CONSTRUCTION

A. Pipe Joints:

1. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
 - a. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
 - b. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.
2. Fill the pipe and fittings during brazing, with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.
3. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

B. Equipment Connections:

1. The Drawings indicate the general arrangement of piping and fittings.
2. Install piping adjacent to machine to allow servicing and maintenance.

3.10 REFRIGERANT PIPING SYSTEMS

A. Inspect, test and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI, "Refrigerant Piping and Heat Transfer Components", 2001, and as follows:

1. All refrigerant tubing shall be tested before tube insulation is applied.
2. Note: The use of compressed air for pressure testing refrigerant tubing will not be permitted.
3. Refrigerant relieve valves, if installed, shall be removed prior to pressure testing and shell openings plugged. After system is tested and found to be completely tight, relief valves shall be reinstalled prior to system evacuation.
4. Each tubing system shall be pressure tested with dry nitrogen. Leaks shall be repaired by removing and remaking the defective joint. No caulking will be permitted. After repair of leaks, system shall be retested and provided tight.
5. Tubing shall be tested per refrigerant manufacturer's recommendations. Tubing shall be tested at a minimum of 550 psig on the high side and on the low side. Do not exceed manufacturer recommendations.
6. Repair leaking joints using new materials, and retest for leaks.

3.11 FIELD QUALITY CONTROL

- A. Division 01 Section: "Quality Requirements and Execution and Closeout Requirements": Field inspecting, testing, adjusting, and balancing.
- B. Test refrigeration system in accordance with ASME B31.5 and International Mechanical Code section 1110.
- C. Repair leaks.
- D. Retest until no leaks are detected.

3.12 ADJUSTING AND CLEANING

- A. Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
- B. Clean and inspect refrigerant piping systems in accordance with industry standards.
- C. Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

3.13 ENGINEERED WALL SEAL AND INSULATION SYSTEM

- A. The wall seal outlet shall be comprised of an elastomeric sleeve and stainless steel clamp. The connecting refrigerant lines exposed to weather shall be thermal insulated. All pipe insulation material (whether it is exterior surface coated or non-coated) shall be completely covered and protected from sunlight, moisture, equipment maintenance, wind, snow, ice, rodent damage, physical damage, and shall provide shielding from solar radiation that can cause degradation of the material.

3.14 FLEXIBLE PVC PLASTIC COVERS:

- A. All pipe insulation material (whether it is exterior surface coated or non-coated) must be completely covered and protected. THE USE OF ANY ADHESIVES IS NOT PERMITTED FOR THIS APPLICATION. Insulation Protector shall be tested and meet the following testing: ASTM E 96 (Vapor Transmission of Materials), ASTM G 153 (Carbon Arc Light Exposure – Accelerated Weathering), ASTM D 412 (Tensile Strength after UV Exposure and Water Immersion), ASTM 570 (Water Absorption of Plastics), ASTM E 84 (Surface Burning Characteristics of Building Materials), ASTM G 21 (Fungal Growth). UV/Protector Pipe Insulation Material shall meet Class II vapor retarder per ASTM E 96 (vapor/moisture permeability test) "1 perm or less". Wrapping Tape or Adhesive Tape shall not be permitted as per energy codes.

END OF SECTION

REFRIGERANT PIPING

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**SECTION 23 30 00
HVAC AIR DISTRIBUTION**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specifications, apply to this section, and all sections of Division 23.

1.2 SUMMARY

- A. Section includes:

1. Duct Materials
2. Duct Applications
3. Duct Systems Fabrication
 - a. General
 - b. Crossbreaking or Cross Beading
 - c. Rectangular Duct Fittings
 - d. Transverse Duct Connection
 - e. Manufactured Turning Vanes
 - f. Round Branch Fittings
 - g. Spin-in Fittings
 - h. Splitter Dampers
 - i. Hangers and Supports
 - j. Sealing Materials
 - k. Casings
4. Air Devices
5. Ductwork Accessories
 - a. Backdraft Dampers
 - b. Manual Volume Control Dampers
 - c. Duct Access Doors
6. Instrument Test Ports
7. Duct Thermometers
8. Louvers
9. Louver Blank-Off Panels
10. Air Filtration Equipment
11. Insulated Equipment Enclosures
12. Ductwork Painting

- B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 03 Sections: "Cast-in-Place Concrete: Requirements for concrete encasements and curbs specified by this section.

2. Division 09 Section: "Painting and Coatings": Requirements for painting or coating as specified in this Section.
3. Division 23 Section: "HVAC Insulation": Execution requirements for insulation as specified by this Section.
4. Division 23: Common Motor Requirements for HVAC Equipment: Product requirements for fan powered terminal units for placement by this section.
5. Division 26 Section: "Low Voltage Electrical Power Conductors and Cables": Requirements for electric wiring and connection to devices and units as specified by this Section.
6. Division 26 Section: "Raceways and Boxes for Electrical Systems": Requirements of conduits and boxes housing electrical wiring and connections as specified by this Section.

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

A. Abbreviations and Acronyms

1. ATC – Automatic Temperature Control
2. BMS – Building Management System
3. LACS – Laboratory Airflow Control System
4. UBC – Usage Based Controls
5. VAV – Variable Air Volume

B. American National Standards Institute

1. ANSI/ASHRAE ® 135-2001: BACnet – A Data Communication Protocol for Building Automation Systems (including standard and all published addenda).

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

1. ASHRAE Handbook - Fundamentals.
2. ASHRAE 52.1 – Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
3. ASHRAE 70 – Method of Testing for Rating the Performance of Air Outlets and Inlets.
4. ASHRAE/ANSI 130, Methods for Testing Air Terminal Units.

D. American Welding Society:

1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.2 - Structural Welding Code - Aluminum.
3. AWS D9.1 - Sheet Metal Welding Code.

E. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A90 - Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

3. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 4. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 5. ASTM A568 - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
 6. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 7. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 8. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 9. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
 10. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 11. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
 12. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
 13. ASTM E1 – Standard Specification for ASTM Thermometers.
 14. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. National Fire Protection Association:
1. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
 2. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
 3. NFPA 92A – Recommended Practice for Smoke-Control Systems.
 4. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- G. International Code Council:
1. International Energy Conservation Code (IECC).
 2. International Mechanical Code (IMC).
- H. Sheet Metal and Air Conditioning Contractors' National Association:
1. SMACNA 016 - HVAC Air Duct Leakage Test Manual.
 2. SMACNA 1767 - Kitchen Ventilation Systems and Food Service Equipment Guidelines.
 3. SMACNA 1884 - Fibrous Glass Duct Construction Standards.
 4. SMACNA 1966 - HVAC Duct Construction Standards - Metal and Flexible.
 5. SMACNA "Duct Cleanliness for New Construction Guidelines".
- I. Underwriters Laboratories Inc.:
1. UL 181 - Factory-Made Air Ducts and Connectors.
 2. UL 181A - Closure Systems for Use With Rigid Air Ducts.

3. UL 555 – Standard for Safety for Fire Dampers.
4. UL 555C – Standard for Safety for Ceiling Dampers.
5. UL 555S – Standard for Safety for Smoke Damper.
6. UL 586 – High –Efficiency Particulate, Air Filter Units.
7. UL 867 – Electrostatic Air Cleaners.
8. UL 900 – Air Filter Units.
9. UL 1978 - Grease Ducts.

J. American Refrigeration Institute:

1. ARI 880 – Performance Rating of Air Terminals.
2. ARI 885 – Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.
3. ARI 850 – Commercial and Industrial Air Filter Equipment.

K. National Electrical Manufacturers Association:

1. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

L. Air Movement and Control Associations:

1. AMCA 500 – Test Methods for Louvers, Dampers, and Shutters.

M. Military Standardization Documents:

1. MIL MIL-STD-282 – Filter Units, Protective Clothing, Gas-Mask Components, and Related Products: Performance-Test Methods.

1.4 DEFINITIONS OF SEAMS AND JOINTS FOR FIELD FABRICATED DUCTWORK

A. Sealing Requirements Definitions: For the purposes of duct systems sealing requirements specified in this Section, the following definitions apply:

1. Seams: A seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on the perimeter are deemed to be joints. Seams also refer to circumferential seams on manufactured fittings.
2. Joints: Joints include girth joints; branch and sub branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum, and casing abutments to building structures.

1.5 SYSTEM PERFORMANCE REQUIREMENTS

- A. The duct system design, as indicated, has been used to select and size air moving and distribution equipment and other components of the air system. Changes or alterations to the layout or configuration of the duct system must be specifically approved in writing. Accompany requests for layout modifications with calculations showing that the proposed layout will provide the original

design results without alteration of system performance, including increasing the system total pressure.

- B. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission of Architect/Engineer.
- C. Size round ducts installed in place of rectangular ducts according to ASHRAE Handbook - Fundamentals.

1.6 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submitted procedures.
- B. Product data including performance data and manufacturers technical details of construction relative to materials, weights, dimensions of individual components, schedules for each type of air devices, terminal units, etc. (fire dampers, smoke dampers, etc.) with location/designation/size/model number, profiles, accessories and finishes for the following items:
 - 1. Duct Materials
 - 2. Duct Applications and Sealing
 - 3. Duct Systems Fabrication
 - a. General
 - b. Crossbreaking or Cross Beading
 - c. Rectangular Duct Fittings
 - d. Transverse Duct Connection
 - e. Manufactured Turning Vanes
 - f. Round Branch Fittings
 - g. Spin-in Fittings
 - h. Hangers and Supports
 - i. Sealing Materials
 - j. Casings
 - 4. Air Devices
 - 5. Ductwork Accessories
 - a. Backdraft Dampers
 - b. Manual Volume Control Dampers
 - c. Duct Access Doors
 - 6. Instrument Test Ports
 - 7. Louvers
 - 8. Louver Blank-Off Panels
 - 9. Air Filtration Equipment
 - 10. Ductwork Painting
- C. Maintenance data for volume control devices, fire dampers, smoke dampers and combination fire/smoke dampers, in accordance with Division 15 Section and Division 01.
- D. Test Reports:

1. Indicate variable air volume, fan powered terminal units and dual duct terminal units meet or exceed specified requirements.
 2. Indicate pressure tests performed, including date, section tested, test pressure, and leakage rate according to SMACNA 016.
- E. Shop Drawings:
1. Submit duct fabrication drawings, drawn to scale not smaller than 1/4 inch equals 1 foot, on sheets same size as Contract Drawings, indicating following:
 - a. Fabrication, assembly, and installation details, including plans, elevations, sections, details of components, and attachments to other Work.
 - b. Duct layout that further indicates pressure classifications and sizes in plan view; exhaust duct systems that further indicate classification of materials handled as specified in this Section.
 - c. Fittings.
 - d. Reinforcing details and spacing.
 - e. Seam and joint construction details.
 - f. Penetrations through fire-rated and other walls.
 - g. Terminal unit, coil, and humidifier installations.
 - h. Hangers and supports, including methods for vibration isolation and building and duct attachment.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- G. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.
- H. Manufacturer's Field Reports: Indicate condition of equipment after start-up including control settings and performance chart of control system.
- I. Manufacturer Instructions:
1. Submit detailed instructions on installation requirements, including storage and handling procedures.
 2. Submit special procedures for glass-fiber ducts.
- J. Qualifications Statements:
1. Submit qualifications for manufacturer, installer, and licensed professional.
 2. Submit manufacturer's approval of installer.
 3. Welders: Qualify procedures and personnel according to AWS D1.1 for hangers and supports, AWS D1.2 for aluminum supports, and AWS D9.1 for duct joint and seam welding.
- K. Wiring diagrams: Submit manufacturer's electrical requirements for VAV Boxes with electric re-heat coils including ladder type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

- L. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.7 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements": Closeout Procedures.
- B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data/procedure.
- C. Record drawings including duct systems routing, fittings details, reinforcing, support, and installed accessories and devices, in accordance with Division 23 Section and Division 01

1.8 QUALITY ASSURANCE

- A. Welded ductwork shall meet the following:
1. Qualify welding processes and welding operators in accordance with AWS D1.1 "Structural Welding Code - Steel" for hangers and supports and AWS D9.1 "Sheet Metal Welding Code."
 2. Qualify each welder in accordance with AWS qualification tests for welding processes involved. Certify that their qualification is current.
 3. Welding certificates including welding procedures specifications, welding procedures qualifications test records, and welders' qualifications test records complying with requirements specified in "compliance listings" below.
- B. NFPA Compliance; Comply with:
1. NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems, "for system components.
 2. NFPA 90B, "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".
 3. Comply with NFPA 255 where applicable for sound attenuators.
 4. NFPA 96, "Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors for Commercial Cooking Equipment," Chapter 3, "Duct System," for kitchen hood duct systems, except as indicated otherwise.
- C. U.L. Compliance; comply with:
1. U.L. Standard 181, Class 1 for flexible ductwork.
 2. Furnish labeled fire dampers; in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers" furnish labeled smoke dampers in accordance with UL Standard 555S "Leakage Systems." Furnish duct liner that meets the erosion test as detailed in UL Publication 181.
- D. ARI Compliance; Comply with:

1. Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
- E. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
- F. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
- G. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
- H. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
- I. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
- J. SMACNA Compliance: Comply with SMACNA duct construction standards (high, medium and low pressure) latest editions as of date of issue of these specifications.
 1. Perform Work according to SMACNA 1884 and 1966.
- K. Dampers tested, rated and labeled in accordance with the latest UL requirements.
- L. Damper pressure drop ratings based on tests and procedures performed in accordance with AMCA 500.
- M. Manufacturers shall be regularly engaged in manufacture of components listed herein with characteristics, sizes, capacities and finished required, and whose products have been proven satisfactory in use for a period of not less than five years.

1.9 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.
- C. Welders: AWS qualified within previous 12 months for employed weld types.
- D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed at Project location

1.10 DELIVERY, STORAGE AND HANDLING

- A. Division 01 Section: "Product Requirements": Product Storage and handling requirements.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

- C. Store materials according to manufacturer instructions.
- D. Deliver sealant and fire-stopping materials to site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.
- E. Store and handle sealant fire-stopping materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- F. Deliver and store stainless steel sheets on exposed ducts, care shall be taken to minimize scratches and marks caused by manufacturing and installation process.
- G. Deliver diffusers, grilles, registers, transfer air devices, etc. wrapped in factory fabricated fiberboard type containers. Each container on outside of container shall include the equipment tag, type of diffuser, griller, register, transfer etc. or air terminal location to be installed and special handling/stacking requirements. Avoid crushing or bending of containers in any way. Prevent dirt or debris, rain, etc, from entering the container during shipment, handling and storage.
- H. Store equipment and devices in original cartons and protect from weather, construction work traffic, and vandalism. Where possible, all equipment/terminals, etc. shall be stored indoors. When necessary to store products outdoors, store above grade on pallets or in trailers and enclose with waterproof wrapping to protect from moisture and weather damage.
- I. Protect dampers from damage to operating linkages and blades.
- J. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.
- K. Handling: Handle and lift dampers in accordance with manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage.
- L. Covers on all containers shall be removed in time to eliminate the possibility of mold growth due to moisture.

1.11 AMBIENT CONDITIONS

- A. Division 01 Section: "Temporary Facilities and Controls": Requirements for ambient condition control facilities for product storage and installation.
- B. Minimum Conditions: Do not install duct sealant when temperatures are less than those recommended by sealant manufacturer.
- C. Subsequent Conditions: Maintain temperatures during and after installation of duct sealant.

1.12 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

- B. Indicate field measurements on Shop Drawings.

1.13 COORDINATION

- A. Division 01 Section: "Administrative Requirements": Coordination and project conditions.
- B. Coordinate Work where appropriate with building control Work.

1.14 WARRANTY

- A. Refer to Division 01 Section: "Execution and Closeout Requirements": for product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for ducts and air terminal units.

1.15 EXTRA MATERIALS

- A. Division 01 Section: "Execution and Closeout Requirements": Spare parts and maintenance products.

PART 2 - PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.
- B. Fasteners: Rivets, bolts, or sheet metal screws.
- C. Hanger Rod: ASTM A36; galvanized steel continuously threaded.
- D. Reinforcing Shapes and Plates: Unless otherwise indicated, provide galvanized steel reinforcing where installed on galvanized sheet metal ducts. For aluminum and stainless steel ducts provide reinforcing of compatible materials.
- E. Tie Rods: Galvanized steel. 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch, minimum diameter for lengths longer than 36 inches.
- F. Security Bars and Frames: Furnish and install security bars and frames with the materials indicated on the drawings.
 - 1. Penetrations Through Interior Security Walls: Bars shall be 7/8" diameter tool resistive steel (Rockwell C-61), spaced at 6" on center vertical, and 12" on center horizontal, set in 2" by 3/8" flat steel retaining bars. Weld retaining bars to head and sill plates.

2. Penetrations Through Exterior Security Walls and Roof: Bars shall be 7/8" diameter tool resistive steel (Rockwell C-61), spaced at 5" on center one way with angle frame embedded in the precast concrete.
- G. General: Furnish and install miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and sizes necessary to comply with duct system requirements, including proper connection of ductwork and equipment.

2.2 DUCT APPLICATIONS AND SEALING

- A. Static-Pressure and Seal Classes: Unless otherwise indicated, construct according to the following:

<u>DUTY</u>	<u>DUCT SYSTEM</u>	<u>SMACNA PRESSURE CLASS (INCHES WG)</u>	<u>GAGE PRESSURE</u>
Supply	Supply Fan to Terminal Diffuser/Grille/Register	3"	Positive
Return/Exhaust	Terminal Equipment (Diffuser/Grille/Register) To Return/Exhaust Box	2"	Negative
Return/Exhaust	Terminal Equipment (Diffuser/Grille/Register) To Return Fan/Exhaust Fan	3"	Negative
Exhaust	Laboratory Exhaust Ductwork	4"	Negative
Outdoor Air	All Outdoor Air Ductwork	2"	Negative

1. Provide 18 gauge minimum duct construction for the first ten (10) feet of supply and return ducts connected to all air handling units. Additionally, provide 18 gauge minimum duct construction for all ductwork located in shafts, including top and bottom elbows/tees.
- B. Duct Sealing:
 1. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible". All ducts shall be completely sealed.
 2. All ducts shall be sealed. As a minimum, seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards – Metal and Flexible":

<u>Type</u>	<u>SMACNA PRESSURE CLASS (INCHES WG)</u>	<u>Positive or Negative Service</u>	<u>Seal Class</u>	<u>Leakage Class</u>

Rectangular Metal	2"	Negative	C	24
Rectangular Metal	3"	Negative	B	12
Rectangular Metal	4"+	Negative	A	6
Round Metal	2"	Negative	C	12
Round Metal	3"	Negative	B	6
Round Metal	4"+	Negative	A	3
Round or Rectangular Metal	2"	Positive	C	6

2.3 DUCT SYSTEMS FABRICATION

- A. General: Except as otherwise indicated, fabricate rectangular ducts with galvanized sheet steel or aluminum; in accordance with SMACNA 1966 "HVAC Duct Construction Standards," Latest Edition, Tables 2-1 through 2-52, including their associated details. Conform to the requirements in the referenced standard for metal thickness, reinforcing types and intervals, tie rod applications, and joint types and intervals.
1. Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
 2. Provide materials that are free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
 3. Make allowance for internal duct lining where required.
 4. Determine duct gauges for the longest duct side and use for all 4 sides. Joints and reinforcing requirements apply to the longest duct side.
 5. Reinforce all ducts to prevent buckling, vibration or noise as recommended in the referenced construction standards and as required to suit the installed conditions.
 6. Do not crossbreak duct which will receive rigid insulation covering.
 7. Where tap sizes of divided flow fittings are not indicated, make branch and main connection sizes proportional to their respective air flows and maintain uniform transverse velocities in the fittings.
 8. Make radius elbows and radius tee connection with throat radius equal to or greater than 1-1/2 centerline width of the duct. Use vaned elbows where shown and where radius elbows will not fit the space in all square bends.
 9. Turning vanes shall be the airfoil type with extended trailing edges 36" maximum length. Where longer vanes are required, use 2 or more sets of vanes with intermediate runners securely fastened together.
 10. Bolts, screws, rivet or spot weld reinforcing members securely to the duct on not less than 6" centers.
 11. Where ducts are open ended without grilles, registers or other means of stiffening, reinforce and stiffen the open end with standing seams or an angle frame.
 12. Paint all cut ends on galvanized angles, rods and other uncoated surfaces with aluminum paint.
 13. Where ductwork is not painted or otherwise finished, remove all exposed traces of joint sealers, manufacturer's identification and other markings.
 14. Aluminum sheet shall be 3003 H14 alloy or duct sheet, 16,000 PSI minimum tensile strength and capable of being formed to a Pittsburgh lock seam.
 15. Reinforcing members for aluminum ductwork may be galvanized steel or aluminum, unless otherwise indicated. Where aluminum reinforcing is used, size the member in

- accordance with ASHRAE recommendations to have rigidity equivalent to listed mild steel angle sizes.
16. Where aluminum ductwork is used, make allowance for increased thermal expansion. Particularly avoid direct contact between aluminum and concrete or masonry walls subject to dampness.
 17. Refer to paragraph 2.26 B for Manual Volume Control Dampers specification.
- B. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20 gauge or less, with more than 10 sq. ft. of unbraced panel area, as indicated in SMACNA "HVAC Duct Construction Standard," Figures: 4-1 and 4-2, unless they are lined or are externally insulated.
- C. Rectangular Duct Fittings: Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA "HVAC Metal Duct Construction Standard," Latest Edition, Figures 2-1 through 2-10.
1. Slide-on Transverse Joint Connectors
Prefabricated slide-on transverse duct connectors and components will be accepted.
 - a. Duct constructed using prefabricates systems will refer to the manufacturer's guidelines for sheet gauge, intermediate reinforcement size and spacing and proper joint reinforcement(s).
 - b. Manufacturers of prefabricated systems must have duct construction and reinforcement guidelines along with supporting independent leakage and deflection performance testing. Manufacturer's prefabricated systems printed assembly and installation procedures must be adhered to during all phases.
 - c. All components of prefabricated system must be clearly embossed with manufacturer's marking and systems manufacturer clearly identified on all duct labels. No substitution of system components is permitted. Approved Manufacturer: Ductmate Industries or Ward Duct Connectors Incorporated "W.D.C.I."
- D. Welding:
1. Continuously Welded Round and Oval Duct Fittings: Two gages heavier than duct gages according to SMACNA 1966.
 2. Cemented Slip Joints:
 - a. Minimum 4 inches.
 - b. Brazed or electric welded.
 3. Prime coat welded joints.
- E. Manufactured Turning Vanes:
1. Furnish and install single thickness, multiple radius, airfoil steel turning vanes. Static pressure loss for square ducts shall be no more than 20% of velocity head. Turning vanes shall be furnished with a mounting plate to facilitate installation in ductwork. Turning vanes shall be Harper double wall turning vanes fabricated from the same material as the duct. Turning vane front and back panels shall be securely locked together with adequate crimping to prevent twisting of vane. Vane shall be capable of withstanding 250 pounds of tensile load when secured according to the manufacturer's

instruction. Rails for mounting turning vanes shall have self locking friction fit tabs designed to facilitate proper alignment of vanes. Tab spacing shall be as specified in Figure 4-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible" Third Edition standard. Rail systems with non-compliant tab spacing shall not be accepted. Acoustical Turning Vane: Shall be used in applications that required quiet operating systems. Mounting rails shall have friction insert tabs that align the vanes automatically. Turning vanes shall be Tuttle and Bailey Model AOOA, Ductmate "PRO-rail," or acceptable comparable product.

F. Round Branch Fittings:

1. Provide take off fittings manufactured with airtight seams using a locking double seam. Units shall be constructed of 26 gauge galvanized steel (minimum). Units shall have a factory installed volume damper with locking spring loaded quadrant. Damper regulator shall be elevated 2" to allow for insulation thickness. Fitting shall be conical type as described on the plans with a base mounting flange secured by a minimum of four sheet metal screws or pop-rivets. See drawings for alternate "Streamline" branch take-off fittings. All High Efficiency Take-Offs, Conicals, and Collars must have a factory applied gasket along all rivets, co-latches, and flange. All fittings shall be constructed from a minimum of 26 gauge steel. All dampered fittings must have low-leakage hardware with closed-end bearings. Manufacturer: Ductmate Industries "GreenSeam Fittings" or acceptable comparable product.

G. Hangers and Supports

1. Building Attachments: Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for building materials. Do not use powder actuated concrete fasteners for lightweight aggregate concretes or for slabs less than 4 inches thick.
2. Hangers: Galvanized sheet steel, or round, uncoated steel, threaded rod.
 - a. Hangers Installed In Corrosive Atmospheres: Electro galvanized, all thread rod or hot dipped galvanized rods with threads painted after installation.
 - b. Straps and Rod Sizes: Conform with Table 5-1, 5-1M, 5-2 in SMACNA HVAC Duct Construction Standards, Latest Edition, for sheet steel width and gage and steel rod diameters.
3. Duct Attachments: Sheet metal screws, blind rivets, or self tapping metal screws, compatible with duct materials.
4. Trapeze and Riser Supports: Steel shapes conforming to ASTM A 36.
 - a. Where galvanized steel ducts are installed, provide hot -dipped- galvanized steel shapes and plates.
 - b. For stainless steel ducts, provide stainless steel support materials.
 - c. For aluminum ducts, provide aluminum support materials, except where materials are electrolytically separated from ductwork.
5. Aircraft cable hanging system with easy lightweight mechanical adjustment system may be used for hanging HVAC and other mechanical applications. Aircraft cable and mechanical hanger shall have a 5 to 1 safety factor. Manufacturers: Ductmate Industries "Clutcher" Cable Hanging System, Gripple, Inc. Cable Hanger System, Erico CADDY SPEED LINK, or acceptable comparable product.

- a. Cable hanging systems with adjustable mechanical devices shall be compliant with SMACNA HVAC duct construction standards, and the authority having jurisdiction's requirements.

H. Sealing Materials

1. Joint and seam sealants:

- a. UL-723
- b. Maximum flame spread of 0 and maximum smoke development of 0
- c. Seal to 15" water gauge and meet the requirements of all SMACNA seal classes
- d. Application method: Brush, spray, or caulk.
- e. Solid Content: Minimum 68% +/-2%
- f. Water resistant
- g. Mold and mildew resistant
- h. Service: Indoor and outdoor
- i. Static pressure rating: 15" water gauge
- j. VOC: 0 g/l
- k. LEED: Meets LEED v4 requirements or later
- l. Emissions: Certified compliant under CDPH V1.1 small chamber emissions testing
- m. Other requirements: Meet FDA, USDA, and EPA standards
- n. UL 181 B-M listed
- o. Acceptable manufacturers: Design Polymerics DP 1010, Ductmate Industries Proseal, or Hardcast Inc. IG-601 Iron Grip

2. Flanged gasket

- a. Gasket size: 5/8" x 3/16", no exceptions
- b. UL 723
- c. Maximum flame spread of 5 and maximum smoke development of 5
- d. For use in TDC and TDF flanges
- e. Mold and mildew resistant
- f. Solid content: 100%
- g. Water resistant
- h. Elongation 600%
- i. Service temperature: -40F to +245F
- j. Other requirements: Meet FDA, USDA, and EPA standards
- k. Acceptable manufacturers: Design Polymerics DP 1040 or Ductmate Industries 440 Butyl gasket tape.

3. Seam sealant

- a. For use in Pittsburg, button punch, and snap lock seams
- b. Non-curing and non-shrinking
- c. Permanently flexible
- d. Pumpable
- e. Water resistant
- f. Service temperature: -40F to +200F
- g. Acceptable manufacturers: Design Polymerics seam sealant or Ductmate Industries 5511M.

I. Casings

1. Fabricate casings in accordance with SMACNA HVAC Duct Construction Standards – Metal and Flexible and construct for operating pressures indicated.
2. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection. Furnish clear wire glass observation ports, minimum 6 x 6 inch size.
3. Fabricate acoustic casings with reinforcing turned inward. Furnish 16 gage back facing and 22 gauge perforated front facing with 3/32 inch diameter holes on 5/32 inch centers. Construct panels 3 inches thick packed with 4.5 lb./cu ft minimum glass fiber media, on inverted channels of 16 gage.

2.4 AIR DEVICES

A. General:

1. Furnish and install air devices where indicated on the contract drawings. Diffusers, registers and grilles shall be of sizes, shapes, capacities and types as indicated on the contract drawings, as required for a complete installation.
2. Performance: Provide diffusers, registers, and grilles that have, as minimum, throw, pressure drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
3. Ceiling Compatibility: Provide diffusers, registers and grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling system with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.
4. For flush mounting, diffuser housing shall be mounted above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
5. For lay-in mounting, diffuser housing shall be sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
6. For wet or humid areas the air devices shall be of aluminum construction.

B. Air device selections are based on manufacturers Model numbers indicated on the contract drawings. The following products of: Titus, Hart & Cooley, Greenheck, Kruger, Metalaire, US Aire, Price, Nailer, or Tuttle & Bailey, Inc. will be accepted provided they meet application, performance and design criteria requirements.

C. Diffusers, registers and grilles shall be furnished with factory installed adjustable baffles to provide air patterns shown on the plans.

D. Air distribution devices have been specifically selected based on Titus <<Insert Manufacturer>> performance data. If devices are submitted, other than those specified, the submittal must include an item by item selection of substitutions listed by space location. This list must include model number, size, air pattern, airflow, pressure drop, throw, NC noise level, finish and mounting method for both the submitted and specified device. Where compliance with performance required different dimensions, such as neck or ace size, than the specified item, the submittal must note where these dimension changes occur listing both the original and new dimensions.

E. Finishes of all air devices shall be baked on enamel, colors shall be selected by Architect.

HVAC AIR DISTRIBUTION

- F. Where air terminal devices are installed in duct collars or branches, furnish and install air extractors. Furnish and install control grids, volume dampers and/or other accessories necessary to ensure uniform air flow across the terminal devices. Accessories shall be of the same material as the terminal device. Install fixed blade terminals so that blades block the normal line of vision. Furnish 3 of each type of removable key operators.

2.5 DUCTWORK ACCESSORIES

A. Backdraft Dampers

1. General

- a. Provide and install factory fabricated backdraft dampers suitable for horizontal or vertical installations.
- b. Frame construction shall be based upon individual application and based on manufacturer's installation instructions for each damper assembly.
- c. Mill finish is standard unless specified otherwise.

2. Manufacturers

- a. Subject to compliance with requirements, provide dampers of one of the following:
 - 1) Ruskin Manufacturing.
 - 2) American Warming and Ventilating.
 - 3) Greenheck Corporation.
- b. Model numbers and features listed below are based on Ruskin Manufacturing.

B. Manual Volume Control Dampers

1. General:

- a. Provide factory-fabricated volume-control dampers, complete with required hardware and accessories. Stiffen damper blades to provide stability under operating conditions. Provide locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class. Provide end bearings or other seals for ducts with pressure classifications of 3 inches or higher. Extend axles full length of damper blades. Provide bearings at both ends of operating shaft. All dampers shall be provided with shaft seals to prevent air leakage.
- b. Where damper or splitter control rods extend through finished walls or ceilings, terminate rods in approved access box equal to Young No. 1 surface mounted quadrant regulator.
- c. All splitter rods shall be provided with Young No. 656-3/8" or 659 – 1/2" end bearings using two (2) bearings per splitter damper.
- d. All ducts larger than 12 x 12 shall be provided with opposed blade dampers.
- e. For square ductwork smaller than 12x12 utilize the following damper:
 - 1) Control dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules.
 - 2) Damper blades shall be 16 ga. Galvanized steel 3V type with three longitudinal grooves for reinforcement. Blades shall be completely symmetrical relative to their axle pivot point, presenting identical resistance

- to airflow and operation in either direction through the damper (blades that are non-symmetrical relative to their axle pivot point or utilize blade stops larger than 1/2 inch are unacceptable). Blade seals shall be TPE. Linkage shall be blade-to-blade concealed in jamb (out of the airstream) to protect linkage and reduce pressure drop and noise.
- 3) Damper frame shall be 16 ga. galvanized steel formed into a structural hat channel shape with reinforced corners to meet 11 ga. criteria. Bearings shall be corrosion resistant, permanently lubricated, synthetic (acetal) sleeve type rotating in extruded holes in the damper frame for maximum service. Axles shall be square and positively locked into the damper blade. Jamb seals shall be flexible stainless steel compression type to prevent leakage between blade end and damper frame.
 - 4) The damper manufacturer's submittal data shall certify all air leakage and air performance pressure drop data in licensed in accordance with the AMCA Certified Rating Program for Test Figures 5.2, 5.3 and 5.5. Damper air performance data shall be developed in accordance with the latest edition of AMCA Standard 500-D.
 - 5) Basis of design shall be Greenheck model VCD-23, comparable products as manufactured by Ruskin or American Warming and Ventilation may be submitted for consideration.
- f. For Round Ductwork 12" in. Diameter and Smaller Utilize the following damper:
- 1) Round control dampers meeting the following specifications shall be furnished and installed where shown on plans and/or as described in schedules. Dampers shall consist of 20 ga. galvanized steel frame, blades fabricated from 20 ga. galvanized steel, and 1/2 in. dia. plated steel axles turning in bronze bearings and EPDM blade seals.
 - 2) Damper manufacturer's printed application and performance data including pressure, velocity, and temperature limitations shall be submitted for approval velocities to 3,000 fpm temperatures to 250°F and leakage to 4cfm/ft² @ 1 in. wg.
 - 3) Testing and rating to be in accordance with AMCA Standard 500-D.
 - 4) Basis of design shall be Greenheck model VCDR-53, comparable products as manufactured by Ruskin or American Warming and Ventilation may be submitted for consideration.
2. Manufacturers:
- a. Subject to compliance with requirements, provide dampers of one of the following:
 - 1) Ruskin Manufacturing.
 - 2) American Warming & Ventilating
 - 3) Greenheck Corporation
 - b. Model numbers and features listed below are based on Ruskin Manufacturing.
3. Standard Duty Manual Volume Dampers:
- a. Frame: 16 gauge galvanized steel structural hat channel with reinforced tabbed corners.
 - b. Blades: 6" wide, single skin, 16 gauge galvanized steel with three longitudinal grooves for reinforcement.
 - c. Linkage: Concealed in frame, out of the airstream.
 - d. Axles: 1/2" plated steel hex, positively locked.
 - e. Bearings: Molded synthetic, corrosion resistant.

- f. Blade seals: PVC coated polyester fabric mechanically locked into the blade edge. Jamb seals shall be flexible metal between blade and frame.
 - g. Control shaft: 1/2" diameter, removable steel shaft.
 - h. Maximum system velocity: 1500 FPM.
 - i. Temperature range: -25°F to +180°F.
 - j. Maximum system pressure:
 - 1) 48" width = 2.5 in. wg.
 - 2) 36" width = 3.0 in. wg.
 - 3) 24" width = 4.0 in. wg.
 - 4) 12" width = 5.0 in. wg.
 - k. Selection based on Ruskin Model No. CD36.
 - l. Application: Parallel blade for mixing air streams and exhaust air duty. Opposed blade for outdoor air ductwork upstream of air monitoring station and adjacent to intake louvers suitable for horizontal or vertical installations.
 - 4. Damper End Switch
 - 5. Damper Actuators
 - a. Refer to Division 23 Section "Instrumentation and Control for HVAC."
- C. Furnish and install access doors and/or panels in high and low pressure ducts, where indicated or required to provide access for control devices, including but not limited to; control dampers, fire dampers, smoke dampers, airflow monitoring stations, etc.
- 1. Access doors in low velocity ducts shall be equal to Prefco CAD-101 or Ductmate "Square Framed Access Doors." Doors shall have galvanized steel frame, with 1" thick, 1-1/2 pcf fiberglass insulation with 24 gauge galvanized steel inner and outer panels. Doors shall be furnished with cam locks.
 - 2. Doors shall be rated for installation in duct systems with pressures up to 8 in w.g. Where required for fire dampers, doors shall be furnished as a factory fabricated unit along with extended sleeve and fire damper (installed downstream of fire damper). Frame shall be 20 gauge galvanized steel with reinforced corners. Doors shall be 20 gauge galvanized steel sheet with 1" inch thick foil faced duct liner insulation, sandwiched to 22 gauge perforated inner line. Door panels shall have spring clips designed to relieve a minimum of 150 cfm at 2 1/2" negative. Panels shall be: 10" x 10" on ducts less than 12" diameter; 12" x 18" on ducts from 12" to 24" diameter; and 18" x 18" on ducts from 26" to 36" diameter.
 - 3. Systems 4" w.g. and above shall utilize a sandwich-type access door. Construct doors in accordance with Figure 7-3 of the 2005 SMACNA Manual, "HVAC Duct Construction Standards, Metal & Flexible" Third Edition. Manufacturer: Ductmate Industries "Sandwich" style door or acceptable comparable product.
 - 4. Grease exhaust duct doors shall be grease and air tight, UL 1978 listed, meet NFPA 96 standards and all mechanical codes. Grease duct access doors can be sandwich type or with a weld on frame, with/without hinge. Manufacturer: Ductmate Industries "Ultimate" style door or acceptable comparable product.
 - 5. All grease duct access doors used shall be accompanied by independent testing in conjunction with each manufacturer's respective wrap system for high temperature applications.

2.6 INSTRUMENT TEST PORTS

- A. Furnish and install instrument test ports in the ductwork to allow use of pilot tube traverses in testing and balancing air systems. Install ports in each main, submain and branch main of all systems including supply, return and exhaust. Place holes on more than 2 sides of larger ducts if required by available pilot tube length. Equip holes with Ventlok #699 instrument ports. Fittings shall extend beyond duct covering.

2.7 DUCT THERMOMETERS

- A. Duct thermometers shall be Johnson Service Co., Powers Regulator Co. or approved equal, 4½" dial, 2°F divisions, cast aluminum case, mercury actuated, brass movement, 8' copper averaging bulb with bronze braided armor, stainless steel connecting tube as required.
- B. Duct thermometers shall be furnished and installed at air handling units as follows:

LOCATION	RANGE
Outdoor Air Duct	-40°F to 120°F
Return Air Duct	30°F to 180°F
Mixed Air Plenum	30°F to 180°F
Supply Air Duct	30°F to 180°F

2.8 LOUVERS

- A. General:
1. Louvers shall be provided under this division and installed under another division.
 2. All louvers shall be by the same manufacturer.
 3. Louvers shall be AMCA 511 rated and carry this seal.
 4. Louvers shall always be caulked, whether they are provided under Architectural Division or provided under Division 23.
- B. Manufacturer:
1. Subject to compliance with requirements, provide louvers of one of the following:
 - a. Ruskin Corporation.
 - b. American Air Warming and Ventilating, Inc.
 - c. Greenheck Fan Corporation.
 - d. Penn Ventilation Company.
 2. Model numbers and features listed below are based on Ruskin model number ELF 675 DX.
- C. Louvers are subject to the following:

1. Performance: High performance with 57% free area with free area velocity of not more than 700 fpm. Louver shall be drainable style.
2. Frame: 4" deep, 6063-T5, .080" thick extruded aluminum.
3. Blades: 6063-T5, .080" thick extruded aluminum.
4. Blade angle: 37.5 degrees.
5. Function: Stationary.
6. Accessories: Birdscreen
7. Finish: Baked enamel
8. Color: The standard color chart shall be submitted for selection by the Architect or Owner.

2.9 LOUVER BLANK-OFF PANELS

- A. Provide blank off panels over unused portions of exterior louvers. Blank off panels shall be 1" air enterprises, Inc. Panel shall be caulked and sealed and shall be attached to aluminum angle frames to provide a neat weathertight enclosure. Paint panels per Architect's directive.

2.10 AIR FILTRATION EQUIPMENT

- A. Acceptable Manufacturers

1. Filters:
 - a. Flanders Precisionaire
 - b. American Air Filter
 - c. Camfil Farr
2. Accessories:
 - a. Air Filter Gages - Dwyer Instruments, Inc.

- B. Filter Cartridges

1. Type F: Medium and High Efficiency Rigid Filters (Lofted Media Type U.L. 900 Class Efficiency levels of MERV 11, MERV 13, and MERV 14)
 - a. Filter Construction
 - 1) Filters shall be the totally rigid type with a lofted microfine synthetic or glass filter media laminated to a non-woven backing. The media shall be supported by an expanded metal support grid bonded to the media to eliminate media oscillation. Media finger supports shall be manufactured of an industrial strength board or galvanized steel and be permanently installed on the air entering and leaving sides, four per side.
 - b. Enclosing Frame
 - 1) The enclosing frame shall be manufactured of 26 gauge galvanized steel and furnished with horizontal and diagonal support members to stabilize and protect the media pack.
 - c. Basis of design: Flanders Corporation Rigid Air.

2. Type G: Medium and High Efficiency Rigid Filters. Separator Type U.L. 900 Class Efficiency levels of MERV 11, 13, and 14 per ASHRAE Std. 52.2-2007
 - a. Filter Construction
 - 1) Filters shall be the totally rigid type, constructed by pleating a continuous sheet of moisture resistant all glass media into closely spaced pleats with hemmed edge aluminum separators.
 - 2) Filter pack shall be sealed in a 24 gauge galvanized steel frame with fire retardant urethane resin potting compound.
 - 3) Media area for a 24 in. x 24 in. x 12 in. size filter shall be 105 square feet for MERV 11 and MERV 13 efficient filters and 125 square feet for MERV 14 efficient filters.
 - 4) Filters shall be U.L. 900 Class 1 construction and so listed.
 - b. Basis of design: Flanders Corporation PrecisionCell.
- C. Modular Framing System (Upstream or Downstream Access)
 1. Medium and high efficiency extended surface ASHRAE rated filters shall be installed in extruded (mill finish) (anodized) aluminum framing modules factory cut, pre punched and packaged with all necessary stiffening members and thread cutting screws for field assembly into modules up to 12 ft. high and 14 ft. wide using only a screwdriver or socket wrench.
 2. The framing members shall be permanently gasketed with a reinforced nylon pile seal to prevent the bypass of unfiltered air. Each horizontal row of filters shall have a positive spring loaded sealing device which will allow easy installation and removal of cartridges from either upstream or downstream access as specified and shall secure the seal between cartridges while the bank is in operation.
 3. A separate track shall be incorporated for 2 in. panel prefilters (if specified) which can be serviced from upstream without disturbing the final filters.
 4. Basis of design: Flanders Corporation K Trac or acceptable comparable product.
- D. Individual Holding Frames for Built up Filter Banks
 1. Type A: Frames for Pleated Filters and Extended Surface High Efficiency Filters
 - a. Three inch deep, 16 gauge (galvanized) (304 stainless) steel with gaskets and filter retaining clips to maintain a positive pressure seal between the frame and the replaceable filter element and matching rivet holes to facilitate installation.
 - b. Provide frames with clips or other means to hold a 2 in. or 4 in. panel prefilter, and/or 12" headered or box style if desired, removable without disturbing the final filter element.
 - c. Basis of design: Flanders Corporation PF-1 Frame.
- E. Side Access Housings, Factory Assembled
 1. Type D: Housings for 2 in., 4 in. or 6 in. Filters (Minimum Inline Depth)
 - a. Housing shall be factory manufactured of 16 gauge galvanized steel and reinforced with "Z" channel bracing to eliminate twisting or racking.

- b. 16 gauge access doors shall be gasketed along the periphery to maintain a proper seal.
 - c. Filter track shall be extruded aluminum and furnished with a polypropylene fin seal gasket.
 - d. Basis of design: Flanders Corporation SurePleat Housing, or acceptable comparable product.
- 2. Type E: Housing for ASHRAE-Rated Extended Area Filters (Two Stage)
 - a. Housing shall be manufactured of 16 gauge galvanized steel and reinforced with "Z" channel bracing. A standing flange on the air entering and air leaving side shall be furnished to facilitate installation.
 - b. Access doors shall be provided with continuous gasketing on the perimeter and positive locking latches with easy grip knobs. Both prefilter and final filter tracks shall be extruded aluminum with polypropylene fin seal gasket to create a positive seal of the filter to the track.
 - c. Factory installed gasketing shall be provided on the vertical sides of cartridges to prevent leakage between cartridges and between cartridges and doors. Filter cartridges shall be capable of removal and loading through either access door.
 - d. The leakage rate of the housing shall be less than 0.5% of air-flow at 6.0 in. w.g. internal static pressure.
 - e. Basis of design: Flanders Corporation SureSeal Housing, or acceptable comparable product.

F. Air Filter Gages

- 1. Dial type, diaphragm-actuated with external zero adjustment and nominal 4 in. diameter dial.
- 2. Provide with two (2) static pressure taps, 2 way valves, tubing and mounting plate (and adjustable signal flag if specified as an option).
- 3. Range shall be as recommended by filter manufacturer.
- 4. Basis of design: Dwyer 2000 Series Magnehelic, or acceptable comparable product. (Others are available upon request.)

2.11 DUCTWORK PAINTING

- A. Paint uninsulated exterior ductwork by applying one base coat, and one finish coat of rust-preventing paint, equal to Rust-Oleum Rust-O-Crylic.
- B. Color shall be as directed by Architect and Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for installation examination.

- B. Verify sizes of equipment connections before fabricating transitions.
- C. Verify rated walls are ready for fire damper installation.
- D. Verify ducts and equipment installations are ready for accessories.
- E. Verify ductwork is ready for air terminal installation.
- F. Check location of air outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement

3.2 PREPARATION

- A. Division 01 Section: "Execution and Closeout Requirements:: Requirements for installation preparation.
- B. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.
- C. Install temporary closures of metal or taped PE on open ductwork to prevent construction dust from entering ductwork system.

3.3 DUCT INSTALLATION, GENERAL

- A. Metal Ducts: Install in accordance with SMACNA 1966 Duct Construction Standards – metal and flexible.
- B. Glass-Fiber-Reinforced Ducts: Comply with SMACNA 1884.
- C. Insulated Flexible Duct Fittings:
 - 1. Join each flexible duct section to main trunk duct through sheet metal fittings.
 - 2. Material: Galvanized steel.
 - 3. Equip fittings with factory-installed volume damper having positive locking regulator.
 - 4. Provide insulation guard with fittings installed in lined ductwork.
- D. Duct System Pressure Class: Construct and install each duct system for the specific duct pressure classification indicated.
- E. Install ducts with the fewest possible joints.
- F. Install louvers and accessories complete with mounting frames as indicated on the drawings. Coordinate all rough opening requirements with all trades prior to fabrication or procurement of any penetrations.
- G. Make all penetrations in exterior walls watertight and weatherproof in accordance with manufacturer's specific installations instructions.

- H. Use fabricated fittings for all changes in directions, changes in size and shape, and connections.
- I. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
- J. Locate ducts, except as otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs. Install duct systems in shortest route that does not obstruct useable space or block access for servicing building and its equipment.
- K. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- L. Provide clearance of 1 inch where furring is shown for enclosure or concealment of ducts, plus allowance for insulation thickness, if any.
- M. Install insulated ducts with 1-inch clearance outside of insulation.
- N. Conceal ducts from view in finished and occupied spaces by locating in mechanical shafts, hollow wall construction, or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown.
- O. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- P. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- Q. Non-Fire-Rated Partition Penetrations: Where ducts pass interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-½ inches.
- R. Outdoor Ductwork: Protect ductwork and ductwork supports, linings, and coverings from weather.
- S. Seam and Joint Sealing:
 - 1. General: Seal duct seams and joints as follows:
 - a. Seal all transverse joints, longitudinal seams, and duct penetrations.
 - 2. Seal externally insulated ducts prior to insulation installation.
- T. Connections:
 - 1. General: Installation specified is for conventional connections not exposed to the weather, high heat, or corrosive agents.
 - 2. Equipment Connections: Connect equipment with flexible connectors in accordance with Division 23 Section: "HVAC Distribution."
 - 3. Branch Connections: Comply with SMACNA "HVAC Air Duct Construction Standards," Figures 2-7 and 2-8.
 - 4. Outlet and Inlet Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figures 2-16 through 2-18.

5. Terminal Units Connections: Comply with SMACNA "HVAC Duct Construction Standards," Figure 2-19.
6. Thermometers and controllers: Cut openings in ductwork to accommodate thermometers and controllers. Cut pitot tube openings for testing of systems, complete with metal can with spring device or screw to eliminate against air leakage.

U. Field Quality Control:

1. Disassemble, reassemble, and seal segments of the systems as required to accommodate leakage testing, and as required for compliance with test requirements.

V. Adjusting and Cleaning:

1. Adjust volume control devices as required by the testing and balancing procedures to achieve required air flow. Refer to Division 23 Section: "TESTING, ADJUSTING, AND BALANCING for HVAC" for requirements and procedures for adjusting and balancing air systems.
2. Vacuum duct systems prior to final acceptance to remove dust and debris.
3. During construction install temporary closures of metal or taped polyethylene on open ductwork to prevent dust from entering ductwork system.

W. Duct Liner Application

1. Adhere insulation with 90% adhesive coverage with mechanical pin fasteners.
2. Secure insulation with mechanical liner fasteners. Comply with SMACNA Standards for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.
6. Follow liner manufacturer's installation instructions.

X. Installation of Flexible Duct Elbow Supports

1. Install flexible duct elbow supports in accordance with manufacturer's instructions.
2. Install flexible duct elbow supports over outer jacket of flexible ducts to form smooth, 90-degree ends to eliminate flexible duct kinks and airflow restrictions.
3. Make bends in flexible ducts with minimum of 1-duct diameter centerline radius.
4. Install flexible duct elbow supports at flexible duct 90-degr bends at following locations:
 - a. Diffusers.
 - b. Grilles.
 - c. Registers.
 - d. Air devices with round inlets and outlets.
 - e. HVAC equipment with round inlets and outlets.
 - f. Flexible ducts used as elbows.
 - g. As indicated on the Drawings.

3.4 LEAK TESTING AIR DISTRIBUTION AND DUCT SYSTEMS

A. Duct Leak Testing:

1. Test the entire ductwork air distribution system.
2. Disassemble, reassemble, and seal segments of systems to accommodate leak testing and for compliance and test requirements.
3. Prior to installing insulation, conduct tests in accordance with SMACNA HVAC air duct leakage testing procedures of reach section of the system. If pressure classifications are not indicated, test entire system at the maximum system operating pressure. Do not pressurize systems above the maximum design operating pressure.
4. Determine leakage from entire system or from each section of the system being tested by relating leakage to the surface area of the test section.
5. Maximum Allowable Leakage: As described in SMACNA HVAC Air Duct Leakage Test Manual "latest edition". Comply with requirements for leakage listed in Division 23 Section: "Air Distribution" – Duct Applications and Sealing.
6. Remake leaking joints as required and apply sealants to achieve specified maximum allowable leakage.
7. Record leakage testing results on forms from the SMACNA HVAC Air Duct Leakage Test Manual, "latest edition". Submit results within one week of testing.

3.5 HANGERS AND SUPPORTS

- A. Install rigid round, rectangular, and flat oval metal duct with support systems indicated in SMACNA "HVAC Duct Construction Standards," Tables 5-1 through 5-4 and Figures 5-1 through 5-11.
- B. Fabricate and support ducts according to SMACNA 1884 and 1966.
- C. Threaded Rods: Provide double nuts and lock washers.
- D. Building Attachments:
1. Provide concrete inserts or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 2. If possible, install concrete inserts before placing concrete.
 3. Powder-Actuated Concrete Fasteners:
 - a. Use only for slabs more than 4 inches thick.
 - b. Install after concrete is placed and completely cured.
 - c. Do not use powder-actuated concrete fasteners for seismic restraints.
- E. Hanger Spacing:
1. Comply with SMACNA 1884 and 1966.
 2. Install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
 3. Extend strap supports down both sides of ducts and turn under bottom at least 1 inch.
 4. Secure hanger to sides and bottom of ducts with sheet metal screws.

- F. Hangers Exposed to View: Provide threaded rod and angle or channel supports.
- G. Vertical Ducts:
 - 1. Support with steel angles or channel secured to sides of duct with welds, bolts, sheet metal screws, or blind rivets.
 - 2. Support at each floor and at maximum intervals of 16 feet.
- H. Upper Attachments:
 - 1. Attach to structures.
 - 2. Selection and Sizing: Provide pull-out, tension, and shear capacities as required for supported loads and building materials.
- I. Penetrations:
 - 1. Avoid penetrations of ducts with hanger rods.
 - 2. If unavoidable, provide airtight rubber grommets at penetrations.
- J. Domestic Clothes Dryer Exhaust Ducts shall be supported at 4-foot intervals and secured in place.

3.6 AIR DEVICE INLETS AND OUTLETS

- A. Inspection:
 - 1. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- B. Installation:
 - 1. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.
 - 2. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work including, but not limited to; sprinkler heads, exit signs, lights, speaker systems, electrical pullbox access, architectural features and ceiling support system.
 - 3. Locate ceiling air diffusers, registers, and grilles, as indicated on the contract drawings. Unless otherwise indicated, locate air device units in center of acoustical ceiling modules or between plaster framing supports/framing in hard ceiling construction.
 - 4. Paint ductwork visible behind air outlets matte black in accordance with Division 09 Section: "Paints and Coatings."
 - 5. Insulate the backs of supply diffusers and tape all around insulation seams.
- C. Spare Parts:
 - 1. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

2. Operating keys shall be tagged similar to piping valve tags and labeled in the Owner's operating and maintenance manual.

3.7 AIR TERMINAL UNIT INSTALLATION

- A. Connect to ductwork
- B. Install ceiling access doors or locate units above easily removable ceiling components.
- C. Support units individually from structure. Do not support from adjacent ductwork.
- D. Support air terminal units connected by flexible duct independently of flexible duct.
- E. Install transition piece to match flexible duct size to inlet or outlet of variable air volume terminal.
- F. Install minimum of 6 ft of 1 inch thick lined ductwork downstream of units.

3.8 DAMPERS, GENERAL:

- A. Provide access to damper components for maintenance of linkage, adjustments and visual inspection.
- B. All dampers shall be installed with their flange outside of the airstream.
- C. Coordinate access to damper with all trades.
- D. Coordinate motor operated damper requirements with Division 23 Section: "Instrumentation and Control for HVAC."
- E. Install volume control dampers in lined duct with methods to avoid damage to liner and to avoid erosion of duct liner material.
- F. Make all adjustments to dampers for proper operation. Backdraft dampers shall be set by the Balancing Contractor upon final system adjustment.
- G. Install balancing dampers on duct take-off to diffusers and grilles and registers, regardless of whether dampers are specified as part of diffuser, or grille and register assembly.
- H. Test and inspect fire and fire/smoke dampers after the first year of installed service, per NFPA 80 and NFPA 105 requirements.
- I. Furnish and install ceiling radiation dampers at all penetrations of the UL listed ceiling assembly. These locations include, but are not limited to, air device locations, duct penetrations, and equipment locations. Refer to detail-typical UL floor/ceiling/roof rated assembly penetrations for more information.

3.9 DUCT MOUNTED ACCESS DOORS:

- A. Install duct mounted access doors at the following locations, and as shown on the contract drawings:
 - 1. Spaced every 50 feet of straight duct.
 - 2. Upstream of each elbow (for grease ducts only)
 - 3. Upstream of each re-heat coil.
 - 4. Before and after each duct mounted filter.
 - 5. Before and after each duct mounted coil.
 - 6. Before and after each duct mounted fan.
 - 7. Before and after each automatic control damper.
 - 8. Downstream of each VAV box.
 - 9. Install at locations for cleaning kitchen exhaust ductwork in accordance with NFPA 96.
- B. Duct access doors shall be installed centered in the width of the horizontal dimension or vertical dimension taking advantage of the most accessible installation for maintenance.
- C. Access doors shall not be covered with insulation.
- D. Install doors prior to performance of ductwork leak testing.

3.10 FILTERS

- A. Install filter frames and assemblies on housekeeping pads where indicated.
- B. Install filter frames level and plumb, following manufacturer's written instructions, rough in drawings, the original design, and referenced standards.
- C. Install air filters and holding devices of types indicated and where shown following air filter manufacturer's written instructions and with recognized industry practices to ensure that filters comply with requirements and serve intended purposes.
- D. Locate each filter unit accurately in position indicated in relation to other work. Position unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.
- E. Install filters in position to prevent passage of unfiltered air. Install felt, rubber, or neoprene gaskets.
- F. Install filter gage for each filter bank.
 - 1. Install filter gauge static pressure taps upstream and downstream of filters to indicate air pressure drop through filter. Mount filter gauges on outside of filter housing or filter plenum in an accessible position. Adjust and level inclined gauges.
- G. Coordinate filter installations with duct and air-handling unit installations.

- H. Manufacturer's Field Service: Provide services of a factory authorized service representative to supervise the field assembly of components and installation of filters and filter frames and electrical wiring. Report results in writing.
- I. After testing, adjusting and balancing air handling and air distribution systems, clean filter housings and install new filter media.
- J. Refer to Division 01 Section: "Sustainable Design, LEED Requirements" for requirements.

3.11 SYSTEM START UP

- A. System start-up shall be provided by a factory-authorized representative of the LACS manufacturer. Start-up shall include calibrating the fume hood monitor and any combination sash sensing equipment, as required. Start-up shall also provide electronic verification of airflow (fume hood exhaust, supply, make-up, general exhaust or return), system programming and integration to BMS (when applicable).
- B. The balancing contractor shall be responsible for final verification and reporting of all airflows.

3.12 CLEANING

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for cleaning.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust.
- C. To obtain sufficient airflow, clean one half of system completely before proceeding to other half.
- D. Vacuuming:
 - 1. Clean duct systems with high-power vacuum machines.
 - 2. Install access openings into ductwork for cleaning purposes.
- E. Protect sensitive equipment with temporary filters or bypass during cleaning.

3.13 CLOSEOUT ACTIVITIES

- A. Training
 - 1. The LACS supplier shall furnish a minimum of eight hours of owner training by factory trained and certified personnel. The training will provide an overview of the job specific airflow control components, verification of initial fume hood monitor calibration, general procedures for verifying airflows of air valves and general troubleshooting procedures.
 - 2. Operation and maintenance manuals, including as-built wiring diagrams and component lists, shall be provided for each training attendee.

3.14 DUCTWORK PAINTING

- A. Apply paint to ductwork per paint manufacturer's written instructions and in accordance with all code requirements.

END OF SECTION

**SECTION 23 34 00
HVAC FANS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specifications, apply to this section, and other sections of Division 23.

1.2 SUMMARY

- A. Section Includes:
1. Wall mounted propeller fans.
 2. Ceiling fans.
- B. Related Sections: The following sections contain requirements that relate to this section:
1. Division 07 Section: "Roof Accessories". Product and Execution requirements for roof curbs etc...
 2. Division 23 Section: "Common Motor Requirements": Product requirements for motors for placement by this section.
 3. Division 23 Section: "Vibration and Seismic Controls for HVAC Piping and Equipment": Product requirements for resilient mountings and snubbers for fans for placement by this section.
 4. Division 23 Section: "HVAC Insulation": Product requirements for power ventilators for placement by this section.
 5. Division 23 Section: "HVAC Air Distribution."
 6. Division 23 Section: "Instrumentation and Control for HVAC": Product requirements for control components to interface with fans.
 7. Division 23 Section: "Pneumatic and Electric Control System for HVAC": Product requirements for pneumatic control components to interface with fans.
 8. Division 26 Section: "Low Voltage Electrical Power Conductors and Cables:" Requirements for electrical wiring and cable connections for units specified in this section.
 9. Division 26 Section: "Raceways and Boxes for Electrical Systems:" Requirements for electrical conduits and boxes housing electrical wiring and connections specified by this section.

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

- A. American Bearing Manufacturers Association:

1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
 2. ABMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- B. Air Movement and Control Association International, Inc.:
1. AMCA 99 - Standards Handbook.
 2. AMCA 200 - Publication, Air Systems
 3. AMCA 201-90 - Publication, Fans and Systems
 4. AMCA 202-88 - Publication, Troubleshooting
 5. AMCA 203-90 - Publication, Field Performance Measurement of Fan Systems
 6. AMCA 204 - Balance Quality and Vibration Levels for Fans.
 7. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
 8. AMCA 211-05 - Publication, Certified Ratings Program – Product Rating Manual for Fan Air Performance
 9. AMCA 260 - Laboratory Methods for Testing Induced Flow Fans for Rating.
 10. AMCA 300 - 96 - Reverberant Room Method for Sound Testing of Fans.
 11. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
 12. AMCA 311-05 - Publication Certified Ratings Program – Product Rating Manual for Fan Sound Performance
 13. AMCA 99-0401-86 - Classification for Spark Resistant Construction
 14. AMCA 99-2408-69 - Operating Limits for Centrifugal Fans
- C. Air Movement and Control Association Inc. (AMCA), American National Standards Institute (ANSI):
1. 204-05 - Standard Balance Quality and Vibration Levels for Fans
 2. 210-99 - Standard Laboratory Methods of Testing Fans for Aerodynamic Performance Rating
- D. American National Standards Institute (ANSI):
- E. 11-r1999 - Method of Evaluating Load Ratings of Bearings
- F. American Refrigeration Institute:
1. ARI 1060 - Air-to-Air Energy Recovery Ventilation Equipment Certification Equipment Program.
- G. American Society of Civil Engineers (ASCE):
1. 7-02 - Minimum Design Loads for Building and Other Structures
- H. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
1. Chapter 45 - 2003 Handbook, HVAC Applications
 2. Chapter 7 - 2001 Fundamentals Handbook, Sound-Vibration
 3. Chapter 32 - 2001 Fundamentals Handbook, Duct Design
 4. Chapter 18 - 1992 HVAC System and Equipment Handbook, Fans
- I. American Society for Testing and Materials (ASTM):

1. E330-02 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylight and Curtain Walls by Uniform Static Air Pressure Difference
- J. National Electrical Manufacturers Association:
1. NEMA MG 1 - Motors and Generators.
 2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- K. National Fire Protection Association (NFPA)
1. 70 - National Electrical Code
 2. 90A-02 - Standard for the Installation of Air-Conditioning and Ventilating Systems
 3. 92A-06 - Recommend Practice for Smoke-Control System
 4. 92B-05 - Standard for Smoke Management System in Malls, Atria, and Large Areas
 5. 96-04 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- L. Occupational Safety and Health Administration (OSHA):
1. 1910.212 - General requirements for Machine Guarding
 2. 1910.219 - General requirements for guarding safe use of mechanical power transmission apparatus
 3. 1926.300 - General requirements for safe operation and maintenance of hand and power tools
- M. Underwriters Laboratories Inc.:
1. UL 507 - Electric Fans.
 2. UL 555 - Fire Dampers.
 3. UL 555S - Smoke Dampers.
 4. UL 705 - Power Ventilators.
 5. UL 762 - Standard Power Roof Ventilators for Restaurant Exhaust Appliances
 6. UL 793 - Snow Load

1.4 SUBMITTALS

- A. Division 01 Section – “Submittal Procedures”: Submittal Procedures.
- B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, and ductwork and accessory connections.
- C. Product Data: Submit data on each type of fan and include accessories, fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit Manufacturer's installation, operations, and maintenance manual, including instructions on installation, operations, maintenance, pulley adjustment, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, warranty and electrical wiring diagrams.

- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.5 CLOSEOUT SUBMITTALS

- A. Division 01 Section – “Execution and Closeout Requirements”: Closeout Procedures.
- B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.6 QUALITY ASSURANCE

- A. Performance Ratings: Conform to AMCA standard 211 and 311. Fans must be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for air performance seal.
- B. Classification for Spark Resistant Construction, levels A, B, and C conform to AMCA 99
- C. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
- D. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- E. Balance Quality: Conform to AMCA 204.
- F. Comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.
- G. The High Wind models have been analyzed and stamped by a state license P.E. to the ASCE 7-02 Standard which meets the IBC, Florida and Miami-Dade codes.
- H. Each High Wind model is subject to be certified by a third party to the ASTM E330 Static Pressure Difference Standard.
- I. All High Wind models have been analyzed using Computational Fluid Dynamics (CFD). The CFD simulates the flow of high speed (150MPH) winds over the surface of objects.
- J. The Finite Element Analysis (FEA) is the results from the CFD and it can accurately predict the stress, strain, and deflection resulting from high wind loads.
- K. Energy Recovery Unit Wheel Energy Transfer Rating: Meet ARI 1060.
- L. Perform Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.8 PRE-INSTALLATION MEETINGS

- A. Division 01 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section – “Product Requirements”: Product Storage and Handling requirements.
- B. Accept fans and components on site in factory protective containers, with factory shipping skids and lifting lugs, inspect for damage.
- C. Protect motors, shafts, and bearings from weather and construction dust.
- D. Delivery: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.
- E. Storage: Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer’s instructions. For long term storage follow manufacturer’s Installation, Operations, and Maintenance Manual.
- F. Handling: Handle and lift fans in accordance with the manufacturer’s instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.11 WARRANTY

- A. Division 01 Section – “Execution and Closeout Requirements”: Product Warranties and Product Bonds.
- B. Furnish two year manufacturer’s warranty for fans.

- C. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
1. The warranty of this equipment is to be free from defects in material and workmanship for a period of one year from the purchase date. Any units or parts which prove defective during the warranty period will be replaced at the Manufacturers option when returned to Manufacturer, transportation prepaid.
 2. Motor Warranty is warranted by the motor manufacturer for a period of one year. Should motors furnished by us prove defective during this period, they should be returned to the nearest authorized motor service station.

1.12 MAINTENANCE SERVICE

- A. Refer to Manufacturer's Installation, Operation and Maintenance Manual (IOM), to find maintenance procedures.
- B. Division 01 Section – "Execution and Closeout Requirements": Requirements for Maintenance Service.
- C. Furnish service and maintenance of fans for one years from Date of Substantial Completion.
- D. Examine each fan's components, per fan manufacturer's recommendations. Clean, adjust, and lubricate equipment.
- E. Include systematic examination, adjustment, and lubrication of fans, and controls checkout and adjustments. Repair or replace parts in accordance with manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
- F. Perform work without removing fans from service during building normal occupied hours.
- G. Provide emergency call back service at all hours for this maintenance period.
- H. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
- I. Perform maintenance work using competent and qualified personnel under supervision of manufacturer or original installer.
- J. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of Owner.

1.13 EXTRA MATERIALS

- A. Division 01 Section – "Execution and Closeout Requirements": Spare Parts and Maintenance Materials.

- B. Furnish two sets of belts for each belt driven fan.

PART 2 - PRODUCTS

2.1 WALL MOUNTED PROPELLER FANS

A. Direct Drive Sidewall Mounted Propeller Fan:

1. Manufacturer:
2. Fans shall meet model numbers, types, sizes, capacities and electric characteristics as indicated on the contract drawings. Acceptable manufacturers: Acme, Greenheck, Cook, Penn Ventilator or Twin City Blower Company.
 - a. Direct Drive Sidewall Mounted Propeller Fan:
 - 1) Fan arrangement shall be either supply or exhaust. Refer to contract drawings for arrangement.
 - 2) Fans shall be suitable for maximum continuous operating temperature 130 Fahrenheit.
 - 3) Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.
 - b. Wheel:
 - 1) Propeller wheel shall be constructed of cast aluminum tapered airfoil blades and cast aluminum hubs.
 - 2) A standard square key and set screw or tapered bushing shall lock the propeller to the motor shaft.
 - 3) Wheel shall be statically and dynamically balanced in accordance with AMCA Standard 204-05.
 - 4) The propeller and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency.
 - c. Motors:
 - 1) Motor enclosures shall be <<Open driproof>> <<Totally enclosed fan cooled>> <<Totally enclosed air over>> <<Explosion resistant>>.
 - 2) Motors shall be permanently lubricated, sleeve bearing type and ball bearing type on to match with the fan load and furnished at the specific voltage and phase.
 - 3) Motor shall be accessible for maintenance.
 - d. Drive Frame:
 - 1) Drive frame assemblies and fan panels shall be galvanized steel.
 - 2) Drive frame shall have welded wire or formed channels and fan panels shall have prepunched mounting holes, formed flanges and a deep formed one piece inlet venture.
 - e. Disconnect Switches:
 - 1) Disconnect provided under Division 26.
 - 2) Disconnect shall be:

NEMA 4: outdoor application hose directed water.
 - 3) Shall have positive electrical shut-off.
 - 4) Shall be wired from fan motor to junction box.
 - f. Accessories:

- 1) Dampers:
 - a) Type Gravity
 - b) Shall prevent outside air from entering back into the building when fan is off.
 - c) Shall be balanced for minimal resistance to flow.
 - d) Shall have galvanized frames with prepunched mounting holes.
 - e) Provide end switch for motorized damper assembly.
- 2) Damper Guards:
 - a) Guard material: <<Galvanized>><<Aluminum>>
 - b) Shall completely enclose the damper or wall opening on the discharge side of the fan.
- 3) Discharge Diffusers:
 - a) Type: 2-way
 - b) Shall be constructed of heavy gauge galvanized steel frame and blades.
 - c) Shall have prepunched mounting flanges
 - d) Shall be designed to mount to the interior end of the wall housing when used in the supply configuration.
- 4) Finishes: **Permator - thermo-setting polyester urethane.**
 - a) Types: Permator
- 5) Wall Collar:
 - a) Constructed of galvanized steel with heavy gauge mounting flanges and prepunched mounting holes.
- 6) Motor Side Guard.
 - a) Guard Type: Standard Guard
 - b) Protective guard shall completely enclose the motor and drive side of the fan,
- 7) Wall Housing Flush Interior:
 - a) Mounting arrangement: Flush Interior
 - b) Shall be constructed of galvanized steel with heavy gauge mounting flanges and prepunched mounting holes.
 - c) Housing shall include OSHA approved motor guard.
- 8) Weatherhood:
 - a) Material type: Galvanized
 - b) Turndown Angle: 45 degrees.
 - c) Screen: Birdscreen
 - d) Finishes:
 - (1) Types: None

B. Belt Drive Sidewall Mounted Propeller Fan:

1. Manufacturer:
 - a. Fans shall meet model numbers, types, sizes, capacities and electric characteristics as indicated on the contract drawings. Acceptable manufacturers: Acme, Cook, Greenheck, Penn Ventilator or Twin City Blower Company.
 - b. Belt Drive Sidewall Mounted Propeller Fan:
 - 1) Fan arrangement shall be either supply or exhaust, refer to contract drawings for arrangement.
 - 2) Fans shall be suitable for maximum continuous operating temperature 130 Fahrenheit.

- 3) Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number.
- c. Wheel:
 - 1) Material type aluminum blades and hubs.
 - 2) Securely attached to fan shaft with standard square key and set screw or tapered bushing.
 - 3) Wheel shall be statically and dynamically balanced in accordance with AMCA Standard 204-05.
 - 4) The propeller and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency.
- d. Motors:
 - 1) Motor enclosures shall be Open dripproof
 - 2) Motors shall be permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
 - 3) Motors shall be accessible for maintenance.
- e. Shafts and Bearings:
 - 1) Fan Shaft shall be ground and polished solid steel with an anti corrosive coating.
 - 2) Bearing shall be stamped steel or cast pillow block.
 - 3) Bearings shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - 4) Bearings shall be air handling quality and shall be 100% factory tested by bearing manufacturer.
 - 5) Fan Shaft first critical speed is at least 25 percent over maximum operating speed.
- f. Drive Frame:
 - 1) Drive frame assemblies shall be galvanized steel, and bolted construction.
 - 2) Drive frame shall have formed channels and fan panels shall have prepunched mounting holes, formed flanges and a deep formed one piece inlet venturi.
- g. Disconnect Switches:
 - 1) Disconnect shall be: **NEMA 4**
 - 2) Shall have positive electrical shut-off.
 - 3) Shall be wired from fan motor to junction box.
- h. Drive Assembly:
 - 1) Belts, pulleys, and keys shall be oversized for a minimum of 150 percent of driven horsepower.
 - 2) Belts shall be Static free and oil resistant.
 - 3) Shall have fully machined cast iron pulleys, keyed and securely attached to the wheel and motor shafts.
 - 4) The motor pulley shall be adjustable for final system balancing.
 - 5) Motor shall be readily accessible for maintenance.
 - 6) Closure Angles:
 - a) Provide extra set of mounting flanges for field installation to close off the interior wall opening for a finished appearance.
 - 7) Dampers:
 - a) Types: Gravity
 - b) Shall prevent outside air from entering back into the building when fan is off.
 - c) Shall be balanced for minimal resistance to flow.

- d) Shall come with galvanized frames with prepunched mounting holes.
- e) Provide end switch for motorized damper assembly.
- 8) Damper Guards:
 - a) Guard material: Galvanized
 - b) Shall completely enclose the damper or wall opening on the discharge side of the fan.
- 9) Diffusers:
 - a) Shall be constructed of heavy gauge galvanized steel frame and blades.
 - b) Shall have pre-punched mounting flanges.
 - c) Shall be designed to mount to the interior end of the wall housing when used in the supply configuration.
 - d) Types: None
- 10) Horizontal Mounting:
 - a) Allows fan to be mounted in a horizontal configuration.
 - b) Location: Motor Top, Air Down
- 11) Wall Housing:
 - a) Mounting arrangement shall be Flush Interior
 - b) Shall be constructed of galvanized steel with heavy gauge mounting flanges and prepunched mounting holes.
 - c) Housing shall include OSHA approved motor guard.
- 12) Wall Collar:
 - a) Shall be constructed of galvanized steel with heavy gauge mounting flanges and pre-punched mounting holes.
- 13) Motor Side Guard:
 - a) Guard type: Standard Guard
 - b) Protective guard shall completely enclose the motor and drive side of the fan.
- 14) Weatherhood:
 - a) Shall shield wall opening and dampers from rain and snow.
 - b) Material type: Galvanized
 - c) Turndown Angle: 45 degrees.
 - d) Screen: Birdscreen
 - e) Finishes:
 - (1) Type: None

2.2 CEILING FANS

A. Direct Drive Premium Ceiling Mounted Centrifugal Exhaust Fans:

1. Manufacturer:

Fans shall meet model numbers, types, sizes, capacities, and electrical characteristics as indicated on the contract drawings. Acceptable manufacturers: Acme, Cook, Greenheck, Penn Ventilator or Twin City Blower Company.

2. General:

- a. Maximum operating temperatures shall be 130 Fahrenheit..
- b. Sound levels shall be as low as 0.7 AMCA sones.

- c. Shall be UL/cUL listed for above bathtub exhaust.
 - d. Fans shall be UL/cUL listed 507 - Electric Fans.
 - e. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number.
- 3. Wheel:
 - a. Shall be forward curved centrifugal wheel.
 - b. Shall be constructed of galvanized steel or calcium carbonate filled polypropylene.
 - c. Shall be statically and dynamically balanced in accordance to AMCA Standard 204-05.
- 4. Motors:
 - a. Motor enclosures shall be open dripproof (ODP), opening in the frame body and or end brackets.
 - b. Motor shall be permanently lubricated sleeve bearing type to match with the fan load and furnished at the specific voltage and phase.
 - c. Motor shall be mounted on vibration isolators and be accessible for maintenance.
 - d. Shall come with thermal overload protection.
- 5. Housing:
 - a. Shall be constructed of heavy gauge galvanized steel.
 - b. Interior shall be lined with 0.5 inches of acoustical insulation.
 - c. Profile shall be as low as 10 ½ inches.
- 6. Provide Spring Loaded Aluminum Backdraft Damper:
- 7. Outlet:
 - a. Shall be field rotatable from horizontal to vertical discharge.
 - b. Duct collar shall include an aluminum backdraft damper.
- 8. Grille:
 - a. Types: <<Designer>> <<Decorative>> <<Aluminum>> <<Stainless Steel>>.
 - b. Shall be constructed of high impact polystyrene for sizes 50 thru 390, plastic shall be factory standard on unit under 390.
 - c. Shall be constructed of aluminum non-yellowing for sizes 410 thru 1550, aluminum shall be factory standard on units over 410.
- 9. Provide External Electrical Access:
 - a. Shall eliminate removing the motor pack on installation.
- 10. Mounting Brackets:
 - a. Shall be adjustable for multiple installation conditions.
- 11. Accessories:
 - a. Disconnect Switches:
 - 1) Disconnect provided under Division 26.
 - 2) Disconnect shall be:
NEMA 1: indoor application no water: factory standard.
 - 3) Shall have positive electrical shut-off.
 - 4) Shall be wired from fan motor to junction box.
 - b. Grille Filter:

- 1) Shall be washable aluminum mesh filter type that shall be installed between fan and grille.
- c. Speed Controls:
 - 1) Shall control the fan's output.
 - 2) Fan shall be capable of being adjusted to 60 percent of full speed.
- d. Vibration Kit:
 - 1) Provide for suspended installations.
 - 2) Provide prepunched hole for ease of installation and provide all hardware to mount one unit.

2.3 CENTRIFUGAL SQUARE INLINE CABINET FANS

A. Direct Driven Backward Inclined Inline Fans:

- 1. Manufacturer:
 - a. Fans shall meet model numbers, types, sizes, capacities, and electrical characteristics as indicated on the contract drawings. Acceptable manufacturers: Acme, Cook, Greenheck, Penn Ventilator or Twin City Blower Company.
- 2. General:
 - a. Shall have a normal operating temperature of up to 130 Fahrenheit (54.4 Celsius).
 - b. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.
- 3. Wheel:
 - a. Shall be non-overloading, backward inclined centrifugal wheel.
 - b. Shall be constructed of aluminum.
 - c. Shall be statically and dynamically balanced in accordance to AMCA Standard 204-05.
 - d. The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency.
 - e. Single thickness blades shall be securely riveted or welded to a heavy gauge back plate and wheel cone.
- 4. Motors:
 - a. Motor enclosures shall be Open drip proof
 - b. Motors shall be permanently lubricated, sleeve bearing type on sizes 8-12 and ball bearing type on sizes 14-24 to match with the fan load and furnished at the specific voltage and phase.
 - c. Motor shall be accessible for maintenance.
- 5. Housing/Cabinet Construction:
 - a. Construction material: Aluminum
 - b. Square design constructed shall be of heavy gauge galvanized steel and shall include square duct mounting collars.
 - c. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.

6. Housing Supports and Drive Frame:
 - a. Housing supports shall be constructed of structural steel with formed flanges.
 - b. Drive frame shall be welded steel which supports the motor.
7. Disconnect Switches:
 - a. Disconnect shall be:
NEMA 1: indoor application no water: factory standard.
 - b. Shall have positive electrical shut-off.
 - c. Shall be wired from fan motor to junction box.
8. Duct Collars:
 - a. Shall be of square design to provide a large discharge area.
9. Access Panel:
 - a. Provide two sided access panels, to allow access to all internal components.
 - b. Locate perpendicular to the motor mounting panel.
10. Accessories:
 - a. Dampers:
 - 1) Types: Gravity
 - 2) Provide galvanized frames with prepunched mounting holes.
 - 3) Shall be balanced for minimal resistance to flow.
 - 4) Provide end switch for motorized damper assembly.
 - b. Finishes:
 - 1) Types: None
 - c. Inlet and Outlet Guards:
 - 1) Shall be constructed of expanded metal mounted in a steel frame to provide protection for non-ducted installations.
 - d. Insulated Housing:
 - 1) Shall be thickness: 0.5 inches.
 - 2) Provide for noise reduction and condensation control.
 - 3) Constructed of fiberglass liner.
 - e. Isolation:
 - 1) Refer to Division 23 Section - "Vibration and Seismic Controls for HVAC Piping and Equipment".
 - f. Motor Cover:
 - 1) Shall be constructed of galvanized steel.
 - 2) Shall cover motor and drives for safety.
 - 3) Shall be standard on units specified with UL.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section – "Administrative Requirements": Coordination and project Conditions.

- B. Verify roof curbs are installed and dimensions are as

3.2 PREPARATION

- A. Furnish roof curbs to Division 07 Section "Roof Accessories" for installation.
- B. Ensure that roof openings are square and/or round and accurately aligned, correctly located, and in tolerance.
- C. Ensure that ducts are plumb, sized correctly, and to proper elevation above roof decks.

3.3 INSTALLATION

- A. Secure fans with stainless steel lag screws to structure.
- B. Suspended Fans: Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.
- C. Install backdraft dampers on inlet to <<roof>> <<and>> <<wall>> exhaust fans <<and>> <<gravity ventilators used in relief air applications>>.
- D. Provide backdraft dampers on outlet from cabinet and ceiling fans and as indicated on Drawings.
- E. Install safety screen where inlet or outlet is exposed.
- F. Pipe scroll drains to nearest floor drain.
- G. Install backdraft dampers on the discharges of exhaust fans when they are not integral with fans and as indicated on the Contract Drawings.
- H. Provide <<fixed>> or <<adjustable>> sheaves as required for final air balance.
- I. Install Work in accordance with all applicable codes, standards, and local authorities having jurisdiction requirements.
- J. Install fans in accordance with the fan manufacturer's instructions and as indicated on the contract drawings.

3.4 MANUFACTURER'S FIELD SERVICES

- A. Division 01 Section – "Quality Requirements": Requirements for Manufacturer's Field Services..
- B. Furnish services of factory trained representative for minimum of day to start-up, calibrate controls, and instruct Owner on operation and maintenance.

3.5 CLEANING

- A. Division 01 Section – “Execution and Closeout Requirements”: Requirements for Cleaning.
- B. Vacuum clean coils and inside of fan cabinet.

3.6 DEMONSTRATION

- A. Division 01 Section – “Execution and Closeout Requirements”: Requirements for Demonstration and Training.
- B. Demonstrate fan operation and maintenance procedures.

3.7 PROTECTION OF FINISHED WORK

- A. Refer to Division 01 Section: “Execution Requirements”: Requirements for protecting finished Work
- B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and each fan has been test run under observation.

3.8 ADJUSTING

- A. Adjust fans to function properly.
- B. Adjust belt tension on belt driven fans.
- C. Lubricate bearing.
- D. Adjust drives for final system balancing.
- E. Check wheel overlap.

END OF SECTION

SECTION 23 81 43

AIR-SOURCE UNITARY HEAT PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specifications, apply to this section, and the other sections of Division 23.

1.2 SUMMARY

- A. Section includes:
 - 1. Unitary heat pumps.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 23 Section: "Common Work Results for HVAC:" Product requirements for electric motors for placement by this section.
 - 2. Division 23 Section: "Common Motor Requirements:" Product requirements for electric motors for placement by this section.
 - 3. Division 23 Section: "Vibration and Seismic Controls for HVAC Piping and Equipment": Product requirements for vibration isolators for placement by this section.
 - 4. Division 23 Section: "Pipes and Tubes for HVAC Piping and Equipment:"
 - 5. Division 23 Section: "Refrigerant Piping:" Execution requirements for refrigerant piping specified by this section.
 - 6. Division 23 Section: "HVAC Air Distribution": Product requirements for flexible connections for placement by this section.
 - 7. Division 23 Section: "Instrumentation and Controls for HVAC:" Execution requirements for connecting units to controls remote from unit specified in this section.
 - 8. Division 23 Section: "Pneumatic and Electric Control System for HVAC:" Execution requirements for connecting units to controls remote from unit specified in this section.
 - 9. Division 26 Section: "Low Voltage Electrical Power Conductors and Cables:" Requirements for connection to air source unitary heat pumps specified by this section.
 - 10. Division 26 Section: "Raceways and Boxes for Electrical Systems:" Requirements of conduits and boxes housing electrical wiring and connections specified by this section.

1.3 REFERENCES

(Unless otherwise noted, references apply to "latest editions.")

AIR-SOURCE UNITARY HEAT PUMPS

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- A. Air-Conditioning Heating, and Refrigeration Institute:
 - 1. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
 - 2. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
 - 3. ARI 340/360 - Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
- B. Air Movement and Control Association International, Inc.:
 - 1. AMCA 500 - Test Methods for Louvers, Dampers, and Shutters.
- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- D. International Organization for Standardization:
 - 1. ISO 13256-1 - Water-Source Heat Pumps - Testing and Rating for Performance - Part 1: Water-to-Air and Brine-to-Air Heat Pumps.
- E. Underwriters Laboratories, Inc.:
 - 1. UL 1995 - Heating and Cooling Equipment.
 - 2. UL-508 - Industrial Control; Equipment

1.4 DEFINITIONS

- A. Coefficient of Performance (COP), heat pump, heating - Ratio of rate of heat delivered to rate of energy input, in consistent units, for complete heat pump system, including compressor and, if applicable, auxiliary heat, under designated operating conditions.
- B. Energy Efficiency Ratio (EER) - Ratio of net cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions.
- C. Heating Seasonal Performance Factor (HSPF) - Total heating output of heat pump during its normal annual usage period for heating (in Btu) divided by total electric energy input during the same period.
- D. Seasonal Energy Efficiency Ratio (SEER) - Total cooling output of an air conditioner during its normal annual usage period for cooling (in Btu) divided by total electric energy input during the same period (in Wh).

1.5 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Shop Drawings: Indicate dimensions, rough-in connections, and duct connections of manufactured products and assemblies. Indicate electrical service with connection requirements.

- C. Product Data: Submit drawings indicating capacity, weights, electrical characteristics and connection requirements. Indicate electrical characteristics.
- D. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.6 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements" Closeout procedures.
- B. Project Record Documents: Record actual locations of controls separate from units.
- C. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.7 QUALITY ASSURANCE

- A. Air Cooled Equipment:
 - 1. Cooling Performance Requirements: Conform to minimum SEER/EER prescribed by ASHRAE 90.1 when tested in accordance with AHRI 210/240
 - 2. Heating Performance Requirements: Conform to minimum HSPF/COP prescribed by ASHRAE 90.1 when tested in accordance with ARI 210/240 and UL 1995.
- B. Sound Rating: Measure in accordance with ARI 270.
- C. Outside Air Damper Leakage: Test in accordance with AMCA 500.
- D. Perform Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.9 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Product storage and handling requirements.
- B. Accept heat pump units on site in factory packaging. Inspect for damage.
- C. Protect heat pump units from damage by providing temporary covers until construction is complete in adjacent space. Protect rooftop heat pump units from damage by storing off roof until roof mounting curbs are in place.

1.11 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.12 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for Compressors.

1.13 MAINTENANCE SERVICE

- A. Division 01 Section: "Execution and Closeout Requirements": Maintenance service.
- B. Furnish service and maintenance of packaged heat pump roof top units for one year from Date of Substantial Completion. Include maintenance items as shown in manufacturer's operating and maintenance data, including filter replacements, fan belt replacement, and controls checkout and adjustments. Furnish 24-hour emergency service on breakdowns and malfunctions.

1.14 EXTRA MATERIALS

- A. Division 01 Section: "Execution and Closeout Requirements": Spare parts and maintenance products.
- B. Furnish one set of fan belts for each unit.
- C. Furnish one set of filters for each unit.

PART 2 - PRODUCTS

2.1 Utility Rebate Application:

- A. The contractor shall provide and submit a utility rebate application to the local utility (BGE Smart Energy Program, or other local utility serving this project area) for the major HVAC equipment. The rebate application shall include all information required by the utility company program administrator including, but not limited to, the application, supporting calculations, analysis, comparison of proposed equipment to base line equipment or system, etc.: all as defined and/or required by the program administrator. The owner shall be listed on the application as the recipient of the full rebate.

2.2 SUMMARY

- A. The contractor shall furnish and install air handling units(s) as shown as scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.
- B. APPROVED MANUFACTURERS
 - 1. Trane
 - 2. Carrier
 - 3. York

2.3 GENERAL

- A. Provide indoor-mounted, draw-thru, packaged air handling unit(s). Unit(s) shall be factory-assembled including direct-expansion evaporator coil, expansion valve(s), check valves, condensate drain pan, centrifugal fan assembly with fan motor(s) and mounting bracket sheaves, drives and belts, filters, and electrical controls. Units shall be suitable for either horizontal or vertical airflow configuration and be used with or without ductwork.

2.4 CASING

- A. Unit casing shall be constructed of zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned and finished with a baked enamel finish.
- B. Unit casing shall be completely insulated with fire-retardant, permanent, foil-faced, odorless glass fiber material.

2.5 FANS

- A. Provide fan section with forward curved, double width, double inlet, centrifugal type fan.
- B. Provide self-aligning, grease lubricated, ball or roller bearings with permanent lubrication fittings.

- C. Factory mount motor on slide rails. Provide access to motor, drive, and bearings through removable casing panels.
- D. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.
- E. Provide cast iron or steel variable and adjustable pitched sheaves, dynamically balanced, bored to fit shafts and keyed.

2.6 COILS

- A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil. Enclose coils with headers and return bends fully contained within casing. Coil shall have factory installed expansion valves and factory pressure and leak tested at 375 psig.
- B. Provide double sloped condensate drain pan constructed of PVC with external connections on either side of unit. The drain pan shall be removable for cleaning.

2.7 MOTORS

- A. For additional static requirements, Odyssey Split Systems offer standard belt drive motors to meet and exceed a wide range of airflow needs.

2.8 FILTERS

- A. Provide one inch throwaway filters, factory installed. Provide access from side panel for removal. Filter rack shall be field convertible to two inch capability with field provided two inch throwaway filters.

2.9 CONTROLS

- A. Provide factory installed and wired controls including fan contactor, low voltage terminal strip and single point power entry.
- B. Provide factory installed FROSTAT to prevent coil freezing at low evaporator temperatures.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements": Coordination and project conditions.
- B. Verify concrete housekeeping pad is sized and located correctly.

- C. Verify piping rough-in is at correct location.
- D. Verify electrical rough-in is at correct location.

3.2 INSTALLATION

- A. Install floor mounted units on 4" high concrete housekeeping pads. Pads to be 6" wider than unit on all sides. Refer to Division 03 Section: "Cast-In-Place Concrete."
- B. Locate remote panels as indicated on Contract Drawings.
- C. Install indoor units on vibration isolators. Refer to Division 23 Section: "Vibration and Seismic Controls for HVAC Piping and Equipment."
- D. Install flexible connections between unit and inlet and discharge ductwork. Install metal bands of connectors parallel with minimum 3 inch (25 mm) flex between ductwork and fan while running. Refer to Division 23: "HVAC Air Distribution."
- E. Install refrigerant piping from indoor to outdoor unit. Install refrigerant specialties specified in Division 23 Section: "Refrigerant Piping."
- F. Install valves and piping accessories on condenser water piping connections as indicated on the Contract Documents. Refer to Division 23 Section: "Piping and Tubes for HVAC Piping and Equipment" and to Division 23 Section: "General Duty Valves for HVAC."
- G. Install condensate piping with trap from drain pan and route to nearest floor drain.
- H. Water-level monitoring devices: On down flow units and all other coils that do not have a secondary drain or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device shall be installed inside the primary drain pan. This device shall shut off the equipment served in the event that the primary drain becomes restricted. Devices installed in the drain line shall not be permitted.
- I. Install accessories furnished loose for field mounting.
- J. Install electrical devices furnished loose for field mounting.
- K. Install control wiring between unit control panel and field mounted control devices.
- L. Install Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.
- M. Refrigerant circuit access ports located outdoors shall be fitted with locking-type-tamper-resistance caps.

3.3 MANUFACTURER'S FIELD SERVICES

- A. Division 01 Section: "Quality Requirements": Manufacturer's field services.

- B. Manufacturer shall furnish a factory trained service engineer without additional charge to start the unit(s) and confirm proper operation. After start-up the manufacturer shall provide a copy of the factory start-up sheets to the owner for documentation on units operating valves.
- C. Furnish initial start-up and shutdown during first year of operation, including routine servicing and checkout.

3.4 CLEANING

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for cleaning.
- B. After construction is completed, including painting, clean exposed surfaces of units.
- C. Vacuum clean coils and inside of cabinets.
- D. Touch up marred or scratched surfaces of factory finished cabinets, using finish materials furnished by manufacturer.
- E. Install temporary filters during construction period. Replace with permanent filters after Substantial Completion.

3.5 DEMONSTRATION

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for demonstration and training.
- B. Demonstrate unit operation and maintenance.
- C. Furnish services of manufacturer's technical representative for one 8 hour day to instruct Owner's personnel in operation and maintenance of units. Schedule training with Owner, provide at least 7 days' notice to Architect/Engineer of training date.
- D. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate and maintain systems.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting up and shutting down, trouble shooting, servicing and maintaining air handling units.
 - 2. Review data in maintenance manuals.
 - 3. Schedule training with owner with at least seven (7) days advance notice.

3.6 PROTECTION OF FINISHED WORK

- A. Refer to Division 01 Section: "Execution and Closeout Requirements" Requirements for protecting finished Work.
- B. Protect finished surfaces of cabinets with protective covers during remainder of construction.

HOLT PARK BUILDING IMPROVEMENTS
BALTIMORE COUNTY, MARYLAND
CONTRACT NUMBER - 25054 GX0
JOB ORDER NUMBER - 0000971385

PROJECT MANUAL
100% CONSTRUCTION DOCUMENTS

END OF SECTION

AIR-SOURCE UNITARY HEAT PUMPS

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SECTION 23 82 00
TERMINAL HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specifications, apply to this section, and the other sections of Division 23.

1.2 SUMMARY

- A. Section includes:
 - 1. Electric wall heaters.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Division 23 Section: "Common Motor Requirements": Product requirements for electric motors for placement by this section.
 - 2. Division 23 Section: "HVAC Air Distribution": Product requirements for flexible duct connections for placement by this section.
 - 3. Division 26 Section: "Low Voltage Electrical Power Conductors and Cables:" Requirements for electric wiring and connections to units specified by this section.
 - 4. Division 26 Section: "Raceways and Boxes for Electrical Systems:" Requirements of conduits and boxes housing electrical wiring and connections specified by this section.

1.3 SUBMITTALS

- A. Division 01 Section: "Submittal Procedures": Submittal Procedures.
- B. Shop Drawings: Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations. Indicate schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers.
- C. Product Data: Submit coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions. Submit mechanical and electrical service locations, capacities and accessories or optional items.
- D. Samples: Submit one sample of each radiation cabinet detailed.
- E. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

TERMINAL HEATING AND COOLING UNITS

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- G. Submission of all submittals shall be made electronically via email with PDF attachments to bowman_submit@bowman.com

1.4 CLOSEOUT SUBMITTALS

- A. Division 01 Section: "Execution and Closeout Requirements": Closeout procedures.
- B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access to valves.
- C. Operation and Maintenance Data: Submit manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Division 01 Section: "Administrative Requirements": Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 Section: "Product Requirements": Product storage and handling requirements.
- B. Accept units on site in factory packing. Inspect for damage. Store under roof.
- C. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Division 01 Section: "Execution and Closeout Requirements": Product warranties and product bonds.
- B. Furnish five year manufacturer's warranty for equipment

1.11 EXTRA MATERIALS

- A. Division 01 Section: "Execution and Closeout Requirements": Spare parts and maintenance products.
- B. Furnish two sets of filters.

PART 2 - PRODUCTS

2.1 Electric Unit Heaters (UH-1, UH-2)

- A. Heaters designed for a single circuit, with elements, motor, and control circuits subdivided with factory wired fuses to conform to the National Electric Code and Underwriter's Laboratory, Inc. Standard 1025.
- B. All heaters equipped with auto reset thermal overloads which shutdown the element and motor if safe operating temperatures are exceeded.
- C. Element, motor and transformer primary fusing are factory installed and wired where required by NEC. Branch circuit fusing installed where required (48 amps and up). Control contactors and control circuit transformers where required are factory installed and wired.
- D. Only direct line supply and thermostat connections in the field are required. Built-in fan override provided to purge unit casing of excess heat after unit shutdown. The units are listed with ETL.
- E. Heaters installed and wired in accordance with the manufacturers recommendations and applicable national and local codes.
- F. Casings fabricated of die-formed, heavy-gauge steel and finished in high gloss, baked enamel.
- G. Supply air drawn through a stamped louver periphery evenly across the heating element, and discharged through an outward drawn venturi. Adjustable discharge louvers provided to control the direction of airflow.
- H. A large hinged access door extends the width of the heater and locked in position by quarter-turn fasteners. Heater and supply wiring diagram permanently attached to the inside of the access door.
- I. Elements are high mass, all steel tubular finned type, copper brazed. Centrally located and installed in fixed element banks.

TERMINAL HEATING AND COOLING UNITS

- J. Motors totally enclosed, all angle industrial rated. Fan blades are axial flow-type designed for quiet efficient operation. Fan speed does not exceed 1600 rpm.
- K. Units are to be free from defective material and workmanship for a period of 1 year with the exception of the heating elements which have a 5 year warranty.
- L. Units utilize sealed bearings to insure permanent lubrication.
- M. Provide remote wall thermostat as shown in contract documents.

2.2 Electric Wall Heater (UH-3)

- A. Furnish and install heavy-duty forced air wall heaters, Series 3320 where specified.
- B. Heaters are architectural styled, constructed of a 18-gauge (1.2 mm thickness) steel housing with a 14-gauge (1.9 mm thickness) extruded aluminum frame. The rugged steel grille and heater box are painted with a rust resistant dark brown baked enamel color finish. Rough-in dimensions of 19 3/16" (487.4 mm) high x 14 3/16" (360.4 mm) wide x 4" (101.6 mm) deep.
- C. Power wiring is connected through two 1/2" (12.7 mm) knockouts in the top of the heater and one 1/2" (12.7 mm) knockout on the bottom of the heater.
- D. The heaters have a low-speed 600 rpm (10 rps), four-pole motor which drives a vane axial blower to deliver a quiet 175 cfm (82.6 l/s) of down flow air.
- E. The heating element are of the sealed tubular type with large, parallel steel fins for quick heat transfer.
- F. Unit's have as standard, thermal overload cut-off for added safety, fan delay switch, manual tamper resistant disconnect switch and a tamper resistant thermostat which are calibrated to provide a range of 55 F (12.8 C) to 85 F (29.4 C). All items factory installed and wired
- G. All heaters are listed by ETL listed. The heating element are supplied with a manufacturer's one - year limited warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 Section: "Administrative Requirements": Coordination and project conditions.
- B. For recessed units, verify recess dimensions are correct size.
- C. Verify wall construction is ready for installation.
- D. Verify ductwork is ready for installation.

- E. Verify concealed blocking and supports are in place and connections are correctly located.

3.2 INSTALLATION

- A. Protect coils to prevent damage to fins and flanges. Comb out bent fins.
- B. Install coils level. Install cleanable tube fluid coils and level frame steam coils with 1: 50 pitch.
- C. Make connections to coils with unions and flanges.
- D. For cooling coils where air velocity exceeds 550 ft/min install three break moisture eliminators of 24 gage galvanized steel.
- E. Install insulation air coil casings. Refer to Division 23 Section: "HVAC Insulation."
- F. Install equipment exposed to finished areas after walls and ceilings are finished and painted. Avoid damage.
- G. Protection: Install finished cabinet units with protective covers during remainder of construction.
- H. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Division 26.
- I. Install Work in accordance with all applicable codes, standards and local authorities having jurisdiction requirements.

3.3 CLEANING

- A. Division 01 Section: "Execution and Closeout Requirements": Requirements for final cleaning.
- B. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- C. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
- D. Install new filters.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

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 and other sections of Electrical and Special Construction Divisions.

1.2 SUMMARY

- A. This section includes qualification requirements of the installer and suppliers, submittal procedures, record keeping, required testing and general electrical procedures.
- B. Section Includes:
 - 1. Additional submittal requirements.
 - 2. Installer and product requirements.
 - 3. Identification of equipment.
 - 4. Firestopping for electrical installations.
 - 5. Supporting devices for electrical components.
 - 6. Concrete equipment pads.
 - 7. Equipment bollards.
 - 8. Fuses.
 - 9. Equipment connections.
 - 10. Cutting and patching for electrical construction.
 - 11. Touch up painting.
 - 12. Electrical demolition.
 - 13. Project conditions.
 - 14. Additional warranties.
 - 15. Utility coordination.
- C. Related Sections:
 - 1. Section "Low Voltage Electrical Distribution" for concrete pad or bollard requirements.
- D. Products installed but not supplied under this Section:
 - 1. Provide electrical connections and materials required for the installation and connections to products of other section, including but not limited to:
 - a. Countertops, Casework & Cabinets.
 - b. Modular office partitions and furniture panels.
 - c. Elevators.
 - d. Fume hoods and/or Bio-Safety Cabinets.
 - e. Exhaust hoods.
 - f. Lab equipment.
 - g. Manufacturing equipment.
 - h. Garage and/or shop equipment.
 - i. Conference Room or other area A/V equipment including projectors, screens, wall monitors, etc.

- j. Break room and lounge appliances.
 - k. Kitchen and food service equipment.
 - l. Common area, public or central laundry equipment.
 - m. Dwelling unit or apartment kitchen and laundry appliances.
 - n. Magnetic door holders.
 - o. Electrically locked doors, door strikes, maglocks, etc.
 - p. Motorized and automatic doors, push plates, sensors, etc.
 - q. Operating Room lights and equipment.
 - r. Sterilization and decontamination equipment.
 - s. Recovery room headwall equipment.
 - t. All apartment Unit appliances, including:
 - 1) Electric or gas ranges.
 - 2) Range hoods.
 - 3) Dishwashers.
 - 4) Garbage Disposals.
 - 5) Washer/driers.
 - 6) Water heaters.
 - 7) Dehumidifiers.
 - 8) HVAC Units and Condensing Units.
 - 2. Coordinate electrical connections with installation requirements and manufacturers' nameplates and written instructions.
 - 3. Verify equipment nameplates and connection requirements prior to rough in.
- E. Permits and Fees:
- 1. Apply, pay for and secure all permits, required by the Authorities Having Jurisdiction prior to start of work, in accordance with contract General Conditions and Division 01.
 - 2. Deliver all certificates to the Owner prior to final acceptance of work.
- F. Alternates: Provide pricing for all work identified as Alternate, Bid Alternate, Add Alternate, etc. Include Electrical Division work associated with the work of other Divisions identified as Alternates.
- G. Conflicts:
- 1. Where variances occur within drawings and/or specifications, procedures of the General Conditions shall be followed.
 - 2. In cases where clarification is not requested, provide the item or arrangement of better quality, greater value, or higher cost in the Contract Price.
 - 3. Bring to the Architect's attention, any field conflicts or existing conditions, which prevent the intended work as designed.

1.3 ACRONYMS

- A. The following acronyms are used throughout the Electrical Division specifications, defined as follows:
- 1. AASHTO American Association of State Highway and Transportation Officials
 - 2. ADA Amer. With Disabilities Act
 - 3. ANSI American National Standards Institute
 - 4. ASME American Society of Mechanical Engineers
 - 5. ASTM American Society for Testing and Materials
 - 6. IBC International Building Code

7.	IEEE	Institute of Electrical and Electronics Engineers
8.	ETL	Electrical Testing Laboratory
9.	FM	Factory Mutual Research Corporation
10.	NEC	National Electrical Code
11.	NECA	National Electrical Contractors Association
12.	NEMA	National Equipment Manufacturers Association
13.	NESC	National Electrical Safety Code
14.	NETA	National Electrical Testing Association
15.	NFPA	National Fire Protection Association
16.	NLPI	Lightning Protection Institute
17.	UL	Underwriter's Laboratories

1.4 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term product includes the terms material, equipment, system, and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, which is current as of date of the Contract Documents.
 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
 3. Comparable Product: Product that is to be demonstrated and approved through the submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes proposed by Contractor in products, materials, equipment, and methods of construction required by the Contract Documents.

1.5 SUBMITTALS

- A. General: Submit each item in this Section according to the conditions of the contract and Division 01 Specification Sections.
- B. Comply with Division 01 Section "Submittal Procedures".
- C. General:
1. Shop Drawings
 2. Product Data
 3. Installation and Coordination Drawings
 4. Record Documents
 5. Operation and Maintenance Manuals
 6. Construction Phasing and Outage Schedule
- D. Submittal Deviations from Contract Documents:
1. Submittals shall explicitly identify any deviations from the drawings, specifications or design intent, including, but not limited to:

- a. Different products used.
 - b. Products used in different locations from where shown or specified.
 - c. Changes to intended application, location, etc.
 - d. Changes to capacity, rating or size.
 - e. Differences in physical sizes, dimensions and/or weights which will create installation, clearance or access problems or Code violations.
 2. Contractor shall clearly and specifically identify each such deviation, substitution or change to the contract documents to Architect's attention via note, clarification, etc. It is NOT considered to be explicitly identified simply by showing a device on the plans or including a product page in the submittal.
- E. Basis-of-Design Comparable Products Submission:
1. Contract Drawings are based on only the named "Basis of Design" products.
 2. Engineer has not verified that any Comparable Products by manufacturers other than the "Basis of Design" equipment will properly fit, perform or meet the design intent and contract documents.
 3. Contractor must verify sizes, ratings, dimensions, clearance requirements, weight, etc. of any/all manufacturers. Contractor is responsible for the fitment of their proposed equipment, and resulting impacts to other construction or disciplines, Code compliance, etc.
 4. Document each Submittal, Comparable Product or Substitution request with supporting data substantiating compliance of proposed product with Basis-of-Design product.
- F. Product Substitutions: Comply with all requirements of Division 01.
- G. Comparable Products Submission:
1. Document each request for a proposed comparable product with supporting data substantiating compliance of proposed product with Basis-of-Design product.
- H. Coordination of Submittals: Coordinate Electrical and Special Construction Division submittals with those of all other Divisions. Also, review submittals of all other disciplines' submittals specifically for proper coordination of electrical circuits, including locations, ratings and types of required connections. Coordinate all electrical provisions and rough-ins with all other project disciplines.
- I. Electrical Division additional submittal requirements: On projects where Div 01 does not specify otherwise, and where Owner does not have a defined submittal procedure, provide submittals, as follows. Where Div 1 specs are applicable, also provide the following.
1. Clearly identify all submittals, as follows:
 - a. Number each submittal starting with the specification section associated with the product(s). Each successive product from same spec section shall utilize a sequential suffix (i.e. -01, -02).
 - b. Following each number, include specific English name of each product. (i.e. Spec Section # - Panelboards).
 - c. Do not combine product data from different spec sections into a single submittal package as this may prevent approval of one product due to resubmission requirement of another.
 - d. Provide catalog spec and/or data sheets to completely describe proposed equipment. A product model number alone, with no supporting description or data will not be approved.

- e. Where numerous models or product numbers appear, clearly indicate the exact type, model number, size, options, and special features of the proposed item.
 - f. Factory order forms showing only required capacities, are not acceptable.
 - g. Identify all options furnished to meet specifications.
 - h. The Architect shall not select or mark equipment ratings and/or options. Submittals not properly and specifically marked shall be returned without review.
 - 2. Identify any discrepancies in the contract documents affecting submittals and seek clarification.
 - 3. Product data PDF's shall contain only product cut sheets, data sheets or catalog pages as pertain the proposed products. Use of manufacturer's PDF catalog pages shall be limited to only those pages relevant to the proposed products. Submittals consisting of entire catalogs of other products, irrelevant data, etc. shall be returned without review.
 - 4. Submit all related product drawings, data sheets, layout drawings, etc. for each system or product in a single submittal. Do NOT submit product data, wiring diagrams and calculations for one product submittal as multiple separate submittals or PDF's.
- J. Product Data:
- 1. Manufacturer's specifications, data sheets.
 - 2. Catalog cuts.
 - 3. Dimensional drawings.
 - 4. Installation Instructions.
 - 5. Wiring & connection diagrams.
 - 6. Capacity ratings, performance curves.
 - 7. Information required indicating contract compliance.
 - 8. Clearly indicate the exact size or rating proposed.
- K. Shop Drawings:
- 1. All specially fabricated items.
 - 2. Modifications to standard items.
 - 3. Specially designed systems or products.
- L. Closeout Submittals: Submit in accordance with the General Conditions and Division 1 requirements.
- 1. Electrical Division Operation and Maintenance Manuals:
 - a. Arrange material in sections according to Electrical Division spec sections.
 - b. Include a cover sheet, which contains the name and phone number of the Installer, Distributor, Supplier, Local Service Company, etc. for each system or product group.
 - c. O & M Manuals shall also include the following:
 - d. Material and Equipment List.
 - e. Copies of all approved submittals.
 - f. Acceptance Test Reports (ground resistance, etc.)
 - g. Manufacturer's Product Warranties.
 - h. Factory data sheets, wiring diagrams, etc.
 - i. Spare parts lists.
 - j. All operation and instruction papers.

- k. Maintenance schedules.
- 2. Record Drawings:
 - a. During construction, maintain drawings on blue or black line white prints.
 - b. Record all changes and alterations in red ink.
 - c. Record the installed electric feeders, equipment, etc.
 - d. Actual installed locations of panels, switchboards, transformers, etc.
 - e. All feeders overhead, underslab or in chases.
 - f. Pullboxes, handholes and splice box locations.
 - g. All underground feeders, conduit, ducts, cables, handholes, manholes, etc. with installed dimensions from permanent construction elements.
 - h. All modifications, changes, deletions or additions made during construction.
 - i. Submit one (1) complete set of contract drawing prints with "as-built" information neatly recorded in RED at project completion. Submit files in PDF format.
- M. Required Submittals: Submit the following items, as a minimum requirement for this project:
 - 1. Section "Common Work Results for Electrical":
 - a. Material and Equipment List
 - b. Coordination Drawings for Electrical, Mechanical, IT Rooms, etc.
 - c. Electrical Installer Qualifications
 - d. Fire Stop materials
 - e. Access Panels
 - f. Copies of Electrical Inspection Reports
 - g. Equipment Acceptance Test Reports
 - h. Completed Punchlist with contractors' initials/dates
 - i. As-Built drawings
 - j. O&M Manuals
 - 2. Section "Low Voltage Electrical Power Conductors and Cables":
 - a. Building wires and conductors.
 - b. Cables and cable assemblies.
 - c. Splices and connectors.
 - d. Cord reels.
 - e. Fabricated drop cord assemblies.
 - f. Mineral Insulated Cable.
 - g. Type RHH/RHW Fire Pump Feeder Cable.
 - h. Acceptance testing of conductors, feeders, etc.
 - 3. Section "Raceways and Boxes for Electrical Systems":
 - a. Conduits.
 - b. Surface raceways.
 - c. Cellular floor duct.
 - d. Countertop outlet boxes.
 - e. Floor mounted devices.
 - f. Power poles.
 - g. Cable trays.
 - 4. Section "Low Voltage Electrical Distribution":
 - a. Current Transformer cabinets.
 - b. Enclosed and automatic circuit breakers.
 - c. Elevator Main Line Disconnects.
 - d. Surge Protective Devices (SPD)
 - e. Submeters.
 - f. Safety Disconnect Switches.

- g. Magnetic Contactors.
- h. Time Clocks.
- i. Panelboards.
- j. Meter Centers.
- k. Switchboards.
- l. Generator Docking Stations.
- m. Post Installation acceptance testing reports.
- n. Post Installation Infrared scanning reports.
- 5. Section "Wiring Devices":
 - a. A/C switches.
 - b. Receptacles.
 - c. Connectors.
 - d. Device plates and covers.
 - e. Pin/sleeve connectors.
 - f. Single/Multiple Station Smoke detectors and accessories.
 - g.
- 6. Section "Lighting":
 - a. Product data for all Individual lighting fixtures.
 - b. LED drivers.
 - c. Low voltage contactor panels.
 - d. Occupancy sensors.
 - e. Line or low voltage room lighting control devices and systems.
 - f. Lighting poles.
 - g. FC calculations
 - h. Wiring diagrams for lighting controls, etc.

1.6 ELECTRONIC AUTOCADD DOCUMENTS

- A. Requests for electronic Autocadd documents will be accommodated to the contractors and installers upon receipt of Bowman's Electronic Document Release Form. Only floor plans and part plan drawings shall be provided.

1.7 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- B. Underwriter's Laboratory (UL) Requirements: All equipment containing electrical components and provided under electrical, mechanical, or other Divisions shall bear the Underwriter's Laboratory (UL) label, as a complete packaged system.
- C. Field Certifications and Labeling:
 - 1. Equipment not provided with a UL label shall be tested in the field certified and provided with a listed label at the installer's expense.
 - a. Field testing shall be performed by a testing agency approved by the authority having jurisdiction.
 - b. Provide services of a UL recognized, independent Electrical Testing Laboratory (ETL) to provide field inspection and testing. Provide an ETL Label on all such equipment as proof of satisfactory inspection.

- D. Fire Safe Materials: Unless otherwise indicated, materials shall conform to UL, National Fire Protection Agency (NFPA) or American Society for Testing and Materials (ASTM) standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.
- E. Install all components and equipment per manufacturer's written instructions.
- F. Installer Qualifications:
 - 1. Provide proof of qualification. Submit the following, when requested:
 - a. Five (5) comparable completed projects.
 - b. Reference letters from minimum of three (3) registered professional engineers, general contractors, or building owners, explaining proficiency, quality of work, or other attribute on projects of similar size or substance.
 - c. Copy of Master Electrician's License.
 - d. Local or State license.
 - e. BICSI RCDD certification, as required in other Electrical Division sections.
 - 2. Electrical installer shall utilize a fulltime project foreman in charge of all electrical work.
 - a. Fully qualified and experienced in such work.
 - b. Available on site at all times during construction.
 - c. All communication shall be through this person.
 - 3. Installer of specialized systems such as Fire Alarms, telecommunication systems, etc. shall meet the requirements of the associated spec section(s).
- G. Installation Quality: In accordance with listed Codes, recognized trade organizations and standards.
 - 1. ADA Americans with Disabilities Act Accessibility Guidelines
 - 2. ANSI/EIA/TIA American National Standards Institute
 - 3. ASME American Society of Mechanical Engineers
 - 4. IEEE C2 National Electrical Safety Code
 - 5. NEMA National Equipment Manufacturers Association
 - 6. NECA National Electrical Contractors Assn Standards of Installation
 - 7. NEMA National Electrical Manufacturer's Association
 - 8. NETA National Electrical Testing Association
 - 9. UL Underwriter's Laboratories
- H. Comply with the latest version of following Codes, Standards and regulations as adopted by the Authority Having Jurisdiction, unless otherwise specified.
 - 1. NFPA
 - 2. NFPA 70 "National Electrical Code".
 - 3. IBC
 - 4. IECC
 - 5. COMAR (Code of Maryland Regulations).
 - 6. State of Maryland Fire Prevention Code
 - 7. Baltimore City Electrical Code
 - 7. Local Amendments to the above Codes

1.8 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
 - 1. Arrange for proper shipping methods for all materials.
 - 2. Provide for handling and unloading of all materials at site or at offsite storage facility.
 - 3. Provide for proper transportation between offsite storage and project site.
 - 4. Provide rigging and other handling services, when necessary.
- B. Storage and Protection:
 - 1. Store all materials in dry, heated areas, unless manufacturers permit other storage environments.
 - 2. Store equipment according to manufacturers' written instructions.
 - 3. Protect materials subject to damage or corrosion from excessive moisture.
 - 4. Protect equipment subject to damage from excessive heat or sunlight in ventilated environments.
 - 5. Protect equipment from dripping, splashing or sprayed materials.
- C. Repair and Replacement of Damaged Equipment: Repair equipment damaged as a result of improper storage or handling at no expense to Owner. If, in the opinion of the Architect, equipment cannot operate properly after repairs are made, replace at no cost to Owner.

1.9 PROJECT CONDITIONS

- A. Occupied Building: Allowances shall be considered and included in bids for performing work within existing, occupied buildings. Certain functions, i.e. core drilling, may be limited in their allowed times, due to disturbance of other occupants. Work occurring within occupied areas may require scheduling of work during unoccupied periods.

1.10 SEQUENCING

- A. General Sequencing:
 - 1. Coordinate electrical work with other trades based on phasing and sequence of construction, as identified elsewhere in the contract documents.
 - 2. Provide all scheduling, phased installation, etc. to coordinate with overall phasing plans.
- B. Electrical Division Sequencing, Coordination, and Integration:
 - 1. Coordinate systems, equipment, and materials installation with other building components.
 - 2. Verify all dimensions by field measurements.
 - 3. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
 - 4. Coordinate the installation of required supporting devices, sleeves and conduit to be set in poured-in-place concrete and other structural components, as they are constructed.
 - 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Make provisions for large equipment requiring positioning prior to closing in the building.
 - 6. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide

- required connection for each service.
- 7. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
- 8. Coordinate requirements for access panels and doors where electrical items requiring access are concealed behind finished surfaces.

1.11 WARRANTY

- A. Provide warranty in accordance with the General Conditions and Division 01 requirements, and as stated herein.
- B. 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.
- C. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 - 1. Manufacturer's Standard Form: Modified to include project-specific information and properly executed.
 - 2. Refer to other specification Sections for specific content requirements and particular requirements for submitting special warranties.
- D. Special Warranties: Provide additional product and/or installation warranties for particular products, as specified within individual specification sections.
- E. Obtain all warranty papers and records from the Original Equipment Manufacturer (OEM) according to their warranty policy and deliver the same to the Owner. Fulfill all the OEM's requirements to validate the warranty at conclusion of project. Include copies of warranty papers with Closeout Submittals.

PART 2 PRODUCTS

2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with Contract Documents, which are undamaged and new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and intended use and effect.
 - 2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. Where products are accompanied by the term as selected, Architect will make selection.
 - 4. Where products are accompanied by the term match sample, sample to be matched is Architect's.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. General Compliance Requirements: Compliance requirements for individual products, as indicated in Contract Documents, are multiple in nature and may include generic descriptions, performance requirements, compliance with reference standards, conformance with graphic details and other similar forms and methods of indicating requirements, all of which must be complied with.

- C. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Document requirements and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.
- D. Products specified by Reference Standards, Codes and Regulations: Select from among products, which can be shown to comply to, referenced documents.
- E. Products specified by Naming Products and Manufacturers: Select from among products listed.
- F. Products specified by Naming One Manufacturer's Product as the Basis-of-Design with Reference to Other Manufacturers: Select either the specified Basis-of-Design product or an approved comparable product by one of the other named manufacturers.
 - 1. Comply with provisions in Comparable Products Article to obtain approval for use of a comparable product by one of the named manufacturers.
- G. Products specified by Naming One Manufacturer's Product and Indicating Option of Selecting Comparable Products by stating or Approved Equivalent or similar language: Select either the specified product or an approved comparable product.
 - 1. Comply with provisions in Comparable Products Article to obtain approval for use of an unnamed comparable product by another manufacturer.
- H. Visual/Aesthetic Match Requirements: Certain products may have been specified or scheduled to achieve a particular appearance, shape, color, etc. This may apply to light fixtures and other products. Where specs or schedules indicate "Color by Architect", a final color selection shall be made from the product manufacturer's product line that includes both standard and premium colors.

2.2 COMPARABLE PRODUCTS

- A. Where Basis-of-Design products are specified by name, submit the following, in addition to other required submittals, to obtain approval of a comparable product by one of the named manufacturers:
 - 1. Evidence that the proposed comparable product does not require revisions to the Contract Documents and is consistent with the Contract Documents.
 - 2. Documentation that the proposed comparable product will produce the indicated results and is compatible with other portions of the Work.
 - 3. Detailed comparison of significant qualities of proposed product with the Basis-of-Design product in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, serviceability, visual effect, and specific features and requirements indicated.
 - 4. Evidence that proposed product provides specified warranty.
 - 5. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 6. Samples, if requested.

2.3 IDENTIFICATION PLATES

- A. General:
 - 1. Dimensions: Minimum of 1" H x 2 1/2" W.
 - 2. Lettering: All capitals, 1/4"H x 1/16" stroke. Indicate circuit number, device

- (EXHAUST FAN 1, PUMP No. 2, etc.).
3. Indoor Tags:
 - a. Laminated phenolic plastic.
 - b. White with black engraved letters.
 - c. Stainless steel attaching screws.
 4. Outdoor Tags:
 - a. Stainless steel tag.
 - b. Stainless steel attaching screws.
 5. Manhole/Handhole Cable Tags:
 - a. Stainless steel tag.
 - b. Nylon cable ties.

2.4 LOW VOLTAGE TERMINAL IDENTIFICATION

- A. Permanent identification in accordance with the manufacturer's shop drawings or product data.
- B. Identify all control cables and wires:
 1. All indoor locations:
 - a. Nylon, self-adhesive.
 - b. Factory printed with permanent numerals/letters on white background.
 2. LEM Wire Markers, or comparable product by 3M or Panduit.

2.5 FIRE STOPPING MATERIALS

- A. General:
 1. UL 1479 Listed, Fire Tests For Through-Penetration
- B. For large openings:
 1. 2-part, RTV silicone elastomer expanding foam.
 2. 3-4X expansion.
 3. STI Pensil Series PEN Foam, Dow Corning Fire Stop Foam, or comparable product by 3M.
- C. For small openings and voids (less than 1"):
 1. 1-part, Intumescent sealant.
 2. Permanent, flexible and resilient.
 3. 5X free expansion.
 4. Red color for instant identification as fire barrier.
 5. 4-hour fire rating.
 6. STI Spec Seal Intumescent Sealant, 3M Fire Barrier Sealant, or comparable product by Dow..
- D. For openings around cable tray penetrations:
 1. Intumescent pillows.
 2. Compressible, lightweight, removable.
 3. Sealed poly bags.
 4. 1/2" expansion in all directions.
 5. STI Spec Seal SSB Pillows, or comparable product by Dow or 3M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:

1. Examine site and existing conditions prior to submitting bids.
2. Carefully examine proposed locations where work will occur in existing buildings and excavation near existing piping, conduit, cable, structures, etc.
3. Make required allowances for the conditions.
4. Request clarifications and or directions in writing, if required.
5. No allowance will be made for any errors, oversights or other negligence on the part of the Installer.

3.2 PREPARATION

A. Protection:

1. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
2. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.3 INSTALLATION

A. General Requirements:

1. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.
2. Install work, generally as shown. Carefully examine all contract drawings and fit the work in each location without substantial alteration. Where departures are proposed or required, submit detailed drawings for acceptance.
3. Installation shall provide the maximum possible headroom where mounting heights or other location criteria are not indicated.
4. Install all items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.
5. Install equipment with proper service and access clearances as required by NEC and manufacturers' requirements.
6. Install such that future service or replacement shall not require interference with or removal of other installations.
7. Provide access to all equipment, splice boxes, switches, controls and other devices, without use of poles, ladders, scaffolding, etc.
8. Where equipment requiring access or service is concealed behind finished surfaces, provide access panel(s) or door(s).

B. Penetration of Fire Rated Construction:

1. Seal all in and around conduits and other electrical materials penetrating or creating openings in fire-rated, fire resistant or fire-stopped walls, ceilings, partitions and floors.
2. Contractor is responsible for the coordination, means & methods, and costs for all penetrations required for the installation of the work.

C. Miscellaneous Supports: Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other

devices except where components are mounted directly to structural features of adequate strength.

- D. Sleeves: Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- E. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Perform fastening according to the following:
 - 1. Fasten by means of wood screws or screw-type nails on wood; toggle bolts on hollow concrete masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and by machine screws, welded threaded studs, or spring-tension clamps on steel.
 - 2. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts, machine screws, or wood screws.
 - 3. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
 - 4. In partitions of light steel construction use sheet-metal screws.
 - 5. Drill holes in concrete beams so holes more than 1-1/2 inches deep do not cut main reinforcing bars.
 - 6. Drill holes in concrete so holes more than 3/4 inch deep do not cut main reinforcing bars.
 - 7. Fill and seal holes drilled in concrete and not used.
 - 8. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.
- F. Rough-in:
 - 1. Contract drawings are generally diagrammatic.
 - 2. Provide all offsets, bends, fittings and accessories, required to fit the work to the conditions, even though not specifically shown.
 - 3. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - 4. Refer to equipment specifications in all other Divisions for rough-in requirements.
 - 5. The Owner, and/or his/her representative, reserves the right to make reasonable changes in location of equipment, conduit and wiring up to the time of rough-in or fabrication.
- G. Cutting and Patching: Provide all cutting and patching in accordance with Division 1 and per the following requirements.
 - 1. Perform all required cutting, fitting, and patching necessary for installation of Electrical Division work.
 - 2. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical systems and equipment as indicated on the drawings and specifications and other electrical items made obsolete by the new Work.

3.4 CONSTRUCTION

- A. Connections to Existing Work:

1. Keep all existing systems in operation during the progress of the work.
2. Provide temporary connections, where necessary to maintain continuous operation until the new systems and equipment are ready for operation.
3. Provide all necessary alterations, cuttings, fitting, etc. of existing work to make satisfactory connections between the new and existing work.
4. Leave the complete work in a neat and finished condition as that of a skilled professional.
5. Relocate existing equipment, conduits, wiring, etc. required. Make changes to existing work as may be required.

B. Interface with Other Work:

1. Mechanical and Plumbing Division Equipment and Systems:
 - a. Provide the following for equipment furnished and/or installed under mechanical/plumbing Divisions, unless specifically noted otherwise:
 - b. Line voltage power wiring connections to equipment such as motors, AHU's, heaters, etc.
 - c. Disconnect means per NEC.
 - d. Manual or automatic starting contactors, starters, switches, etc.
 - e. Furnish duct smoke detectors and sampling tubes. Install detectors into bases and make all wiring connections (mechanical Division to install sampling tubes into ductwork).
 - f. Provide power to all motor operated smoke dampers furnished and installed under other Divisions. Coordinate control operation through fire alarm duct detectors, per Section "Fire Detection and Alarm".
 - g. Furnish gas/oil burner emergency shutdown switches at boiler room exits per NFPA. Provide all wiring to gas or oil-fired boilers and/or water heaters for manual shutdown. Final connections to equipment or associated control panels shall be by mechanical Division.
 - h. Mounting and connection of starters, speed controls, variable frequency drives and other such equipment furnished by mechanical Division.
 - i. Low voltage wiring between transformers and plumbing fixtures (faucets, toilets, urinals, etc.) for automatic controls, or line voltage wiring to fixtures, as required by equipment furnished under mechanical Divisions.
2. All electrical work performed under mechanical and/or plumbing Divisions shall be provided in accordance with electrical specification Divisions.
 - a. Work performed/provided by mechanical Division shall include the following, unless specifically noted otherwise:
 - b. All low voltage and line voltage control wiring including conduits, wiring, branch circuit breakers, etc.
 - c. BMS or ATC system wiring and connections.
 - d. Line voltage connections to all motor operated dampers, automatic valves, etc.
 - e. Line voltage thermostats and associated wiring.
 - f. All relays, contacts and other control equipment required for operation of mechanical Division equipment.
 - g. Fuses within equipment, switches, control panels, etc. furnished from the factory with the equipment.
 - h. Installation of duct smoke detector sampling tubes. Tubes furnished under Section "Fire Detection and Alarm".
3. It is the intent to provide a complete and operational system. The work between mechanical and electrical Divisions is complementary and is meant to produce a single and operating system. Contractor shall make its own determination as to the distribution of responsibility among the various trades.
4. Equipment specified in other Divisions: Provide the following for equipment

furnished and/or installed under Divisions, unless specifically noted otherwise:

- a. Fume, grease and/or exhaust hoods: provide power wiring and connections to all. Field wire and connect installation all items furnished loose with grease extraction and/or fume hoods, including:
 - 1) Lights
 - 2) Receptacles
 - 3) Toggle switches
 - 4) Associated backboxes
- b. Laboratory Benches: Provide power and low voltage conduit connections to lab benches, island and peninsulas.
 - 1) Benches with vertical utility chases: Provide conduit feeds from overhead, routing conduit and/or MC cables vertically through utility chase(s).
 - 2) Benches without utility chase but connected to column or wall: Provide conduit feeds from overhead, routing conduit and/or MC cables vertically through stud wall or column enclosure and into casework.
 - 3) Free-standing island benches without utility chase: Provide conduit feeds from floor below, routing conduit vertically through core drilled holes into casework.
- c. Lab or manufacturing equipment: Provide all rough-ins, outlets and/or hardwired connections.
- d. Modular Office Furniture: Flexible conduit connections to pre-wired modular office furniture and partition walls from columns, walls or floor boxes, per drawings:
 - 1) Conduit(s) with power wiring.
 - 2) Conduit(s) for telecomm wiring.
- e. Kitchen, kitchenette, coffee or break room equipment and appliances: Provide all rough-ins, outlets, and/or hardwired connections.
- f. Elevators: Provide all power and low voltage rough-ins and connections to elevators and associated equipment, including:
 - 1) Elevator controller(s)
 - 2) Cab lights
 - 3) Fire alarm connections for recall and/or shunt trip operations.
- g. Televisions and flat screen monitors: Provide power outlets and low voltage wiring backbox/conduit to all wall or ceiling mounted devices.

C. Routing of Electrical Feeds to Roof Mounted Equipment:

- 1. Conduit routing to roof mounted equipment shall be made to minimize the amount of conduit exposed above the roof.
- 2. Route conduit from building interior within roof curbs, where possible.
- 3. For condensing units and similar equipment, route conduit with refrigerant lines, using common penetrations through roof, coordinated with piping.
- 4. Where conduit must be run horizontally on roof surface, follow other piping, refrigerant lines, etc. Provide blocking, etc. to support conduit at regular intervals, per NEC. Secure conduit to blocks, supports, etc. to prevent movement.

D. Penetration of Waterproof Construction:

- 1. Minimize penetration of roofs, exterior walls and interior waterproof construction.
- 2. Provide necessary curbs, sleeves, shields, flashing, fittings and caulking to make the penetrations watertight.
- 3. All penetrations shall comply with roof manufacturer's recommended materials

and methods.

E. Penetration of Fire Rated Construction:

1. Seal all in and around conduits and other electrical materials penetrating or creating openings in fire-rated, fire resistant or fire-stopped walls, ceilings, partitions and floors.

3.5 DEMOLITION

- A. Remove and dispose of all existing materials not required for re-use or re-installation.
- B. Deliver on the premises, where directed, existing material and equipment which is to be salvaged and remain property of Owner.
- C. All other materials removed shall become the property of the Contractor and shall be removed from the premises.
- D. Remove conduit, hangers, supports, etc. to a point below the finished floors or behind finished walls and cap. Cut such items flush with masonry surfaces.
- E. Remove wiring and conduit back to source panelboard or switch, or to last remaining device on the circuit. Remove conduit, hangers, supports, etc. unless otherwise noted. Conduit may remain to be reused for new work provided it is of the specified size and type and in condition acceptable to Architect.
- F. Any conduit abandoned in concrete slabs, walls, or other inaccessible locations shall be left with a nylon pull wire. Ends shall be capped with push plugs for future use.
- G. Abandoned Wiring & Cables: Remove all abandoned line voltage and low voltage cabling and wiring from the project scope area (including above ceilings and below access floors) per NEC requirements. This shall include all control wiring, IT/telecomm, security, video, power, lighting and any other electrical systems where the wiring is no longer in use. Removal shall include wiring and cables abandoned under this project, and those previously abandoned under prior construction projects.
- H. Outdoor/Exterior Demolition Work:
1. If cable cannot be removed due to collapsed duct, etc., cut cable at conduit entrance at each end and tag cable ends as "Abandoned Cable, Collapsed Duct" or similar reason.
 2. Remove outdoor pad-mounted gear, including concrete pads, ducts, etc. down to 48" below final grade.
 3. Remove overhead lines, poles, lights, etc. including service drops or laterals, conduit stubups, cable, pole base foundations and hardware.
 4. Remove and/or relocate all lighting, poles, wires, conduits, base foundations, etc. associated with roads and fences being demolished or affected by such work.

3.6 RE-INSTALLATION

- A. Where equipment is to be removed, and relocated or re-installed, provide careful removal of all items.
- B. Temporarily store all materials and equipment, which are to be re-installed. Protect from damage. Replace any items damaged during removal, storage or re-installation.

- C. Notify Owner immediately of any damaged or non-functioning equipment prior to removal or disconnecting. Document in writing or with photographs. Replace any damaged items for which Owner was not notified, at no cost to Owner.
- D. Where outlets, panelboards, loadcenters, or other devices and equipment are noted as being relocated or installed in a new location, new mounting height, etc., provide all required modifications to raceways, backboxes, wiring, mounting, supports, etc. and provide pullboxes, splice boxes, etc. as required for the modifications and/or relocation.

3.7 REPAIR/RESTORATION

- A. Restore all finishes, equipment and surfaces to original condition, where affected by the work. Provide the following, as applicable:
 - 1. Replace damaged ceiling tiles.
 - 2. Replace ceiling tiles where removal has left holes or cuts in original tiles.
 - 3. Patch, repair and repaint all walls and surfaces cut, penetrated or otherwise disturbed by the work.
 - 4. Patch holes and penetrations in masonry and plaster.
 - 5. Provide suitable coverplates for all recessed backboxes of equipment removed and not covered by new devices.
 - 6. Provide larger trim or cover plates for new devices, where old backboxes, holes, etc. are not concealed by new work.
 - 7. Patch finished surfaces and building components using new materials matching existing materials and experienced Installers qualified with the materials and methods required for the surface and building components being patched.
- B. Disturbance of Existing Fire Proofing:
 - 1. Where work of this contract causes disturbance, damage or removal of any existing fire proofing material, the contractor shall restore the original fireproofing after work is completed. Fire proofing shall be as specified in another section of the contract specifications or shall match the existing conditions.

3.8 FIELD QUALITY CONTROL

- A. General:
 - 1. Provide all circuits free from ground faults, short circuits and open circuits
 - 2. Perform tests specified or required to demonstrate that the work is installed and operating properly.
 - 3. Where specific tests are required, give proper notice and perform all necessary preliminary tests to assure that the work is complete and ready for final test.
 - 4. Other tests of a specific nature for special equipment shall be as specified under the respective equipment.
- B. Acceptance Testing: Provide for acceptance testing of electrical equipment, as follows, and as required in other electrical Division specification sections.
 - 1. Pay for and schedule all required acceptance testing.
 - 2. Testing shall be by independent electrical testing contractor, licensed and certified by NETA.
 - 3. Testing company shall be independent of installing company (i.e. no

- subsidiaries).
- 4. All tests shall be performed in accordance with the National Electrical Testing Association (NETA).
- 5. Notify Architect and Owner in advance of all testing.
- 6. Deliver all reports to Architect for approval.
- 7. Retest all failed equipment after adjustment, repairs, etc.
- 8. Provide all fuel, labor, etc. required for tests.
- 9. All costs associated with preparations for actual testing shall be borne by the installer.
- 10. Provide letter or statement on Testing Agency letterhead attesting to the satisfactory test results and suitability of the equipment to be energized and/or placed into service, as applicable. If testing reveals any problems or marginal results, the letter shall state these.

C. Replacement of Faulty Work or Materials:

- 1. Replace any equipment, which fails NETA test results at the direction of the Owner. All replaced equipment shall be retested at no cost to Owner.
- 2. Remove and replace all defective Work or materials.
- 3. Remove and replace Work not conforming to requirements of the Contract Documents.
- 4. Materials not installed per recognized standards, manufacturers' instructions, contract documents or design intent shall be removed and replaced when so directed by the Architect, at the Contractor's expense.

D. Project Punchout Inspection: Architect/Engineer will perform punch out reviews and will provide the Contractor with a list of punch list items to be completed before contract close out. Each and every punch list item shall be initialed and dated by the Contractor when the work is complete. The Architect/ Engineer will not perform any punch list verification until all items have been completed, initialed, dated and the list returned to the Architect/Engineer. If any items have been initialed as being completed by the Contractor and the Architect/Engineer determines that the work is not complete, the Architect/Engineer shall be reimbursed by the Contractor at his regular hourly rate for any and all items requiring revisiting of the site by the Architect/Engineer. Reimbursement shall be made by deducting the Architect/Engineer's fee from the Contractor's final payment.

3.9 ADJUSTING

A. General:

- 1. Lubricate, clean, adjust and test all equipment and systems in accordance with the manufacturer's instructions prior to initial operation.
- 2. Do not operate equipment unless proper safety devices and controls are operational.
- 3. Provide all maintenance and service for equipment, which is operated during construction, and protect the equipment.
- 4. Provide services of the manufacturer's factory-trained technicians to start up the equipment where required or specified.

3.10 IDENTIFICATION

A. Permanently identify all equipment in accordance with the project nomenclature.

- 1. Panelboards - identify each panel as per contract, voltage, emergency or UPS

- power (as applicable), and source panel as applicable.
 - i.e. PANEL RP1
120/208 VOLTS, 3P, 4W
EMERGENCY POWER
FED FROM PANEL MDP
 - 2. Fused switches, starters, disconnects - identify fan, pump or load served and source circuit using contract nomenclature. Include emergency power ID, as applicable,
 - i.e. EXHAUST FAN NO. 1
Circuit RP1-1
 - 3. Residential Meter Stacks – identify the meter stack main OCPD as the Service Disconnect. Also identify each outgoing feeder breaker and associated unit served.
 - 4. Miscellaneous controls, terminal boards, etc.
 - i.e. FIRE ALARM POWER SUPPLY
Circuit ELSR-3
 - 5. General purpose receptacles - identify branch circuit panel and circuit number on back of coverplate with permanent marker.
- B. Identify all power conductors via colored insulation, or individual identification of phase wires with colored electrical tape at all terminations, splices and connection points within each junction box, panel or enclosure where conductors are visible. Color coding as listed below, on all building wiring and feeders:
- 1. 208/120-V System: As follows:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 - 2. 120/240-V 1-Phase System:
 - a. Line 1: Black.
 - b. Line 2: Red.
 - c. Neutral: White.
 - d. Ground: Green.

3.11 EQUIPMENT MOUNTING

- A. Disconnects & Control Equipment:
- 1. In sight of equipment served, with operating handle at 48-54" AFF.
 - 2. As close as practical to motor, etc.
 - 3. For large on-grade or roof mounted equipment, (i.e. chillers, ACU's, etc.), mount to equipment housing or frames.
- B. Allow for proper clearance of electrical items and equipment served.

3.12 DEMONSTRATION

- A. Provide for equipment manufacturers' established representatives to demonstrate to Owner, the correct operation, safety, adjustments and maintenance of all electrical equipment and systems under this contract.

END OF SECTION

SECTION 26 05 19

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Building wires and conductors.
2. Load balancing.

B. Related Sections:

1. Section "Common Work Results for Electrical."
2. Section "Grounding & Bonding for Electrical Systems" for coordination with grounding equipment and attachments.
3. Section "Raceways and Boxes for Electrical Systems."

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM B3 Soft or Annealed Copper Wire
2. ASTM B8 Concentric Lay Stranded Copper Conductors
3. ASTM B174 Standard Specification for Bunch-Stranded Copper Conductors for Electrical Conductors
4. ASTM B230 Standard Specification for Aluminum 1350-H19 Wire for Electrical Purposes
5. ASTM B231 Concentric-Lay-Stranded Aluminum Conductors
6. ASTM B496 Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors
7. ASTM B787 Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation
8. ASTM B800 Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes—Annealed and Intermediate Tempers
9. ASTM B801 Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation
10. ASTM B836 Standard Specification for Compact Round Stranded Aluminum Conductors Using Single Input Wire Construction
11. ASTM 901 Standard Specification for Compressed Round Stranded Aluminum Conductors Using Single Input Wire Construction

B. Underwriters Laboratory (UL):

1. UL 4 Standard for Armored Cable

2.	UL 44	Standard for Thermoset-Insulated Wires and Cables
3.	UL 62	Standard for Flexible Cord and Cables
4.	UL 83	Thermoplastic-Insulated Wires and Cables
5.	UL 486A	Standard For Wire Connectors and Soldering Lugs for Use With Copper Conductors
6.	UL 486B	Standard For Wire Connectors and Soldering Lugs for Use With Aluminum Conductors
7.	UL 854	Service-Entrance Cables
8.	UL 910	Standard for Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air]
9.	UL 1424	Standard for Cables for Power-Limited Fire-Alarm Circuits
10.	UL 1569	Standard for Metal-Clad Cables
11.	UL 1479	Standard for Fire Tests of Through-Penetration Firestops
12.	UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords

1.4 SUBMITTALS

- A. Submittal Requirements of this section:
1. Building wires and conductors.
- B. Product data, including construction, materials, performance data, etc.
- C. Product Test Reports: Certified copies of manufacturer's design and routine factory tests required by the referenced standards.
- D. Provide submittal data for each cable or conductor type.
1. To verify specifications have been met/exceeded.
 2. Indicate UL listing for all products.

1.5 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT

- A. Packing, Shipping, Handling and Unloading:
1. Deliver wire and cable according to NEMA WC-26, "Binational Wire and Cable Packaging Standard."
- B. Storage and Protection:
1. Store wires and cables out of rain.
 2. Protect from physical damage.
 3. Guard against nicks and scratches.

PART 2 PRODUCTS

2.1 METAL CLAD CABLE (MC)

- A. Type MC metal clad cable for branch circuit applications.
1. Interlocking aluminum or galvanized steel armor.
 2. THHN/THWN-2 insulation, 90°C rated dry or wet.
 3. Solid Conductors through #10 AWG: Soft or annealed per ASTM B3.

4. Stranded copper conductors for #8 AWG and larger, per ASTM B8 or B787
5. Phase identified conductors.
6. Insulated (green) equipment grounding conductor.
7. Internal, overall, non-metallic tape shield around all conductors.
8. UL 83, 1479, 1569, 1581 listed and tested per UL 2556. .
9. NEC 230, 300, 320, 330, 518, 520, 530, 605 and 645 compliant.
10. AFC MC, MC-Tuff, MC-Lite, or comparable product by Encore Wire, Southwire or Service Wire.

2.2 600 VOLT BUILDING WIRE

A. Copper Building Wire:

1. UL 44, 83 and 854 Listed, 600 volt, 90°C:
2. All conductor sizes indicated are based on copper conductors.
3. Copper, stranded for #8 AWG, and larger.
 - a. Concentric per ASTM B3, B8, B787.
 - b. Compact round per ASTM B496.
4. #12 AWG minimum conductor size.
5. Thermoplastic Insulation:
 - a. Interior #8 and smaller: THWN-2 or THHN
 - b. Interior #6 and larger: THWN-2 or THW-2
 - c. All exterior wiring: THWN-2 or THW-2
6. Provide wires as manufactured by Pirelli or comparable product by Service Wire Corp, Okonite Company, Encore Wire, Southwire, Carol Cable, OmniCable, or Regency.

2.3 DWELLING UNIT BRANCH CIRCUIT CABLE

A. Provide one of the following for dwelling unit branch circuits from dwelling unit load center to new outlets, fixtures, appliances, etc.

B. Type MC metal clad cable:

1. Interlocking galvanized steel or aluminum armor.
2. THHN insulation, 90°C rated.
3. Solid Conductors through #10 AWG: Soft or annealed per ASTM B3.
4. Stranded copper conductors for #8 AWG and larger, per ASTM B8, B787.
5. Phase identified conductors (black, white, red, etc).
6. Insulated (green) equipment grounding conductor.
7. Internal, overall, non-metallic tape shield around all conductors.
8. UL 83, 1479, 1569, 1581 listed and tested per UL 2556.
9. NEC 210, 215, 230, 300, 330, 392, 518, 520, 530, 605 and 645 compliant.
10. AFC MC Cable, AFC MC-Tuff or comparable product by Encore Wire, Service Wire Corp or Southwire.

C. Type NM-B Non-Metallic Sheathed Building cable (for circuits < 50 amps):

1. PVC insulation, 90°C rated.
2. 600V rated
3. Solid conductors through #10 AWG: Soft or annealed per ASTM B3.
4. Stranded copper conductors for #8 AWG and larger, per ASTM B8.
5. Phase identified conductors (black, white, red).
6. Bare copper grounding conductor.

7. Overall PVC sheath. Color coded for gauge (white #14, yellow #12, orange #10).
8. UL 83, and 719 listed and tested per UL 2556.
9. NEC 334 compliant.
10. Southwire SIMpull NM-B Cable, or comparable product by Encore Wire, Service Wire Corp, Cerrowire, Nexans, or Republic.

2.4 SPLICES & CONNECTORS

A. Splices & Connectors for copper conductors:

1. Dry locations:
 - a. #10 AWG and smaller: Insulated, solderless pressure type.
 - b. #8 AWG and larger: Hydraulic pressure indentation type, Burndy "Hy-dent", or comparable product by T&B.
2. In handholes, manholes and direct buried locations:
 - a. Silicone filled wire-nuts (King, or equal).
 - b. Compound filled splice or connectors.
 - c. Suitable for immersion in water.

B. Splices & Connectors for aluminum conductors:

1. All locations: Use only with UL Listed bolted pressure or compression type connectors.
 - a. UL Listed, marked AL7CU or AL9CU per UL 486B.
 - b. Use with oxide inhibiting compound.
 - c. Use aluminum alloy hardware per ANSI requirements.

2.5 LOW VOLTAGE CABLING

- A. Cables for low voltage systems shall be as specified in other sections. If not specified, cables shall be per system manufacturer's recommendations.
- B. All low voltage cabling installed on this project shall be UL Listed, plenum rated cable, unless installed in metal conduit.

PART 3 EXECUTION

3.1 APPLICATION

A. Branch Circuits:

1. Type THHN/THWN-2, copper conductor, in raceway.
2. Type MC cable, copper conductor, 90C insulation.

B. Dwelling Unit Branch Circuits:

1. Type MC cable, copper conductor, 90C insulation.
2. Type AC cable, copper conductor, 90C insulation.
3. Type NM-B non-metallic sheathed cable, copper conductors. For circuits ≥ 50 Amps, use Type THHN/THWN-2 or XHHW-2 aluminum conductor, Type SER Cable.
4. Exterior wiring from disconnect switch to condensing units, or other outdoor equipment. etc.:
 - a. Individual XHHW-2/THW-2/THWN-2 copper conductors in flexible non-

- metallic conduit.
- b. Type UF cable, copper conductor, Listed for exposed exterior locations per UL 493.
- 5. Exposed wiring within HVAC Closets (where closet is a plenum space):
 - a. Type MC cable with smooth corrugated sheath, copper conductor, 90C insulation.
 - b. Type NM-B non-metallic sheathed cable, copper conductors, installed within a short section of EMT conduit, as permitted by NEC.
 - c. Type XHHW-2/THHN/THWN-2, copper conductor, in metal raceway.
 - d. Individual XHHW-2/THHN/THWN-2 copper conductors in flexible metallic conduit (maximum of 4 LF).

3.2 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation."
- B. Remove existing wire from raceways before pulling in new wire and cable.
- C. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.
 - 1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- E. Conductor Splices: Keep to minimum.
 - 1. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
 - 2. Use splice and tap connectors that are compatible with conductor material.
- F. Terminations:
 - 1. Terminate all conductors on distribution or utilization equipment as indicated.
 - 2. Strip insulation per manufacturers' instructions.
 - 3. Where equipment is not furnished with manufacturer's lugs, provide properly rated and sized lugs
 - 4. Where conductors have been oversized due to voltage drop or other requirements and cannot be accommodated under the standard lugs, contractor shall provide larger lugs to fit the conductors.
 - 5. If lugs are not available to terminate the oversized conductors, contractor shall provide in-line (straight) splices at an approved location as close to the termination lugs as possible. Conductor size shall be reduced at the splice to the maximum size which the lug can accommodate.
 - 6. In no case shall the conductors be reduced to a size rated less than the feeder or circuit overcurrent protection.
 - 7. Removal of individual conductor strands is not permitted.
 - 8. Where feeders contain conductor quantities which exceed the available lugs,

- contractor shall provide larger lugs to accommodate the additional conductors.
9. If lugs are not available the installed conductor quantity, contractor shall provide splices at an approved location (external to the equipment), but as close to the termination lugs as possible. Conductor quantities shall be reduced at the splice to the maximum number which the lug can accommodate.
- G. Wiring at Outlets: Install with at least 12 inches of slack conductor at each outlet.
- H. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, per manufacturer's published torque values or per UL 486A.
- I. Use of Aluminum Conductors:
1. Panel and feeder schedules are generally based on copper conductors, unless specifically noted as aluminum.
 2. Where aluminum is to be used, as permitted in these specs, the contractor is responsible for increasing the conductor sizes to meet the equivalent ampacity of specified copper conductors per 75 degree column in NEC tables.
 3. Where required as a result of larger aluminum conductors, provide increased conduit sizes.
 4. Ground conductors shall also be provided, per NEC article 250.
 5. Provide all required lugs, connectors, etc., rated for aluminum conductors.
- J. AC & MC Cable Installation Requirements:
1. Installed concealed in finished areas.
 2. Do not expose, except for final connections to modular furniture.
 3. Group all AC/MC cables running together in bundles with nylon cable ties.
 4. Route bundles neatly through ceiling cavities.
 5. In high ceiling, or large plenum areas, install all AC/MC cables in groups, tight to underside of deck, within steel joist webbing.
 6. Avoid constant changes in direction and elevation of bundles.
 7. Install perpendicular and parallel to column lines, except for final separation from bundles.
 8. Support bundles at regular intervals, per NEC, independent from ceiling hanger wires.
 9. Provide adequate clearance above accessible ceiling tiles, minimum of 18."
 10. Where circuits exit panelboards not located in electrical rooms or closets, conductors shall be installed in EMT conduit to a wire trough above the panel and finished ceiling, in an accessible location. AC/MC cable shall then be permitted to extend to the branch circuit devices.
 11. Where circuits exit panelboards located in electrical rooms or closets, conductors shall be installed in EMT conduit to a wire trough outside the electric room, above the finished ceiling in an accessible location. AC/MC cable shall then be permitted to extend to the branch circuit devices.
- K. Type NMB Sheathed Cable Installation Requirements:
1. Installed concealed in finished areas within apartment/dwelling units only.
 2. Do not expose to weather, sunlight or excessive moisture.
 3. Secure all NMB cables at boxes and termination points per NEC.
 4. Route cables neatly through studs, joists and other construction.
 5. Protect all cables with nailing clips where used in wood stud construction, per

NEC.

6. Provide non-metallic grommets to protect cables passing through metal studs.
7. Support/secure cables at regular intervals, per NEC.
8. Provide cable grip fittings where ever cables enter/exit boxes, panels, etc.

3.3 CONSTRUCTION

- A. Food Service Equipment connections: All power cord or sealtite conduit connections shall be of sufficient length to permit removal and unplugging of equipment. Cord/conduit length, however, shall not allow any cord or conduit to lie on the floor when equipment is in final operating position.
- B. Generators, motors, vibrating or rotating equipment shall be stranded copper for all sizes. Solid wire not permitted.

3.4 FIELD QUALITY CONTROL

- A. General:
 1. Before making tests, complete all connections at panels, fixtures and other equipment.
 2. Install fuses and have all wiring continuous from service equipment to utilization outlets.
 3. Correct all undesirable ground, open and short circuit conditions.
 4. Provide source of temporary power for making tests if normal building power is not available at the time.
- B. Acceptance Testing: Take and record the following readings on systems 600 volts and below:
 1. Provide megger tests of all feeder conductors, including ground conductors for the following:
 - a. Service entrance conductors
 - b. Panelboard, MCC and dry transformer feeder conductors
 - c. Emergency system feeders including feeders between generators, ATS', panels, switchboards.
 - d. Fire Pump feeders (normal and emergency feeders)
 2. Indicate measured Ammeter readings on all phases and neutral of each feeder to indicate balance.
 3. Ammeter readings on all phases of each poly-phase motor. Include nameplate full load current of each motor on data sheet.
- C. Test Reports:
 1. Certify that all overload devices have been set in accordance with data shown on the drawings and/or manufacturer's recommended setting.
 2. Send final certified test reports and Certifications to Architect and Owner for approval, in accordance with Section "Submittals."

3.5 ADJUSTING

- A. General:
 1. Make and perform all adjustments after building distribution system and all

- branch circuits are installed and operating.
 - 2. Make all ammeter measurements during regular working hours, when all personnel and equipment are working, to represent typical building conditions.
- B. Feeder Balancing:
 - 1. Make adjustments to branch circuit connections within branch circuit panelboards. Balance the load between each phase, as practicable.
 - 2. After branch panels are balanced, perform balancing of phase loads on distribution panels and switchboards.
 - 3. Report ammeter readings before and after adjustments for each panel or switchboard.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Conduits.
 - 2. Conduit fittings and supports.
 - 3. Device and outlet boxes.
- B. Related Sections: The following sections contain requirements that relate to this Section:
 - 1. Section "Common Work Results for Electrical."
 - 2. Section "Low Voltage Electrical Power Conductors and Cables" for conductors to be installed in raceways.

1.3 SUBMITTALS

- A. Submittal Requirements of this section:
 - 1. Conduits & fittings.
- B. Descriptive Data:
 - 1. To verify specifications have been met/exceeded.
 - 2. Indicate UL listing for all products.
 - 3. Manufacturer's specifications, data sheets.
 - 4. Catalog cuts.
 - 5. Dimensional drawings.
 - 6. Capacity ratings.
 - 7. Information required indicating contract compliance.
 - 8. Clearly indicate the exact size or rating proposed.
- C. Closeout Submittals: Submit in accordance with the General Conditions and Division 01 requirements.

1.4 DELIVERY, STORAGE AND PROTECTION OF EQUIPMENT

- A. Packing, Shipping, Handling and Unloading:
 - 1. Transport and handle all equipment to prevent bending, distortion or damage to products.
- B. Storage and Protection:

1. Store all materials out of rain.
2. Protect from physical damage.
3. Guard against nicks and scratches on finished surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide the named "Basis of Design" manufacturer and model ("Basis of Design" fixtures are indicated on the drawing fixture schedule), or a comparable product of one of the other following named manufacturers:
1. Steel Conduits & Fittings:
 - a. Allied Tube & Conduit
 - b. American Electric/Steel City
 2. Non-Metallic Conduits & Fittings:
 - a. Carlon
 - b. Cantex
 3. Surface raceways & Multi-outlet assemblies:
 - a. Legrand Wiremold
 - b. MonoSystems, Inc.
 - c. Hubbell

2.2 METAL CONDUIT AND TUBING

- A. PVC-Coated Steel Conduit:
1. NEMA RN 1 PVC Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 2. UL 6 Electrical Rigid Metal Conduit - Steel.
 3. Meets NEC Article 346, "Rigid Metal Conduit."
 4. Material: Steel heavy-wall, hot dip galvanized inside and outside.
 5. Coating: 40 mil PVC exterior; urethane coating interior.
 6. Joints: Standard pipe thread; furnished with PVC coated coupling; shipped with thread protector through 2-inch size.
 7. Minimum Size: 3/4 inch.
 8. Robroy Plasti-bond Red.
- B. Electrical Metallic Tubing (EMT):
1. ANSI C80.3 Electrical Metallic Tubing - Zinc Coated.
 2. UL 6 Rigid Metal Conduit.
 3. Meets NEC Article 358, "Electrical Metallic Tubing."
 4. Material: Steel, thin-wall, electro-galvanized.
 5. Minimum Size: 3/4 inch.
- C. Flexible Metal Conduit (Greenfield):
1. UL 1 Flexible Metal Conduit.
 2. Meets NEC Article 348, "Flexible Metal Conduit."
 3. Material: Electro-galvanized, or zinc-coated steel.
 4. Minimum Size: 3/4 inch.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Rigid Nonmetallic Conduit (RNC):

1. Schedule 40 or 80 PVC.
2. Meeting NEMA publication TC-2, "Electrical Plastic Tubing" (EPT) and "Conduit" (EPC-4 and EPC-80).
3. UL-651 Schedule 40 and 80, "Rigid PVC Conduit."
4. Material complies with ASTM D 1784, "Standards for PVC compounds and CPVC compounds."
5. Meets NEC Article 352, "Rigid PVC Conduit."

2.4 CONDUIT FITTINGS

A. All fittings to match conduit material and to be suitable for the purpose intended. All fittings shall be UL Listed.

B. EMT Fittings:

1. Compression type "Concretight" or "Raintight."
2. Zinc plated steel body and steel nut.
3. Insulated throats.
4. Setscrew fittings not permitted.

C. Sealtite Conduit Fittings:

1. Threaded ferrule, malleable iron compression nut and body.
2. Nylon sealing ring.
3. NEMA FB-1, "Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies."

D. PVC Conduit Fittings:

1. Formed PVC, sunlight and UV resistant, UL Listed.
2. Schedule 40 or 80 to match conduit or tubing type and material.
3. Material complies with ASTM D 1784, "Standards for PVC compounds and CPVC compounds."
4. Meets NEC Article 347, "Rigid Nonmetallic Conduit."
5. Meeting NEMA publications TC-3, "PVC Fittings for use with Rigid PVC Conduit and Tubing."
6. Fittings Listed under UL-514B, "Fittings for Cable and Conduit."
7. Medium voltage underground or sub-slab conduit systems:
 - a. Minimum 36" bend radius for all conduit turn-ups into gear or pads.
 - b. 25 ft radius, long-sweep bends for all bends and offsets in underground or sub-slab runs.
 - c. End bells with smooth, flared ends for all conduits terminating under pad-mounted switchgear, switchboards, transformers, etc.
8. Telecommunication underground or sub-slab conduits:
 - a. Minimum 36" bend radius for all 2" and larger conduits.
 - b. 25 ft radius, long-sweep bends for all bends and offsets in underground or sub-slab runs.
9. Conduit and elbows with factory belled end.
10. Carlon Plus 40 conduit and fittings, or equal.

2.5 CONDUIT SUPPORTS

- A. Single suspended feeder conduit:
 - 1. 1/2" - 2" Conduit: Adjustable hangers with 3/8" rods.
 - 2. > 2" Conduit: Adjustable hangers with 1/2" rods.
 - 3. Kindorf C-149 or C-150, B-line, or equal.
- B. Groups of suspended conduits:
 - 1. Steel channels with conduit straps.
 - 2. 1/2" threaded rods, minimum.
 - 3. Kindorf, B-Line, or equal.
- C. Flexible metal conduit, MC Cable:
 - 1. UL Listed Caddy Clips, or similar attachment methods.
- D. Surface mounted conduit:
 - 1. 1 or 2-hole pipe straps.

2.6 DEVICE & OUTLET BOXES

- A. Indoor boxes - zinc-coated or cadmium plated steel, NEMA OS-1.
- B. Wiring device boxes for surface mounting in unfinished spaces:
 - 1. Full-size (4" high) boxes required for all wiring devices (switches, outlets, etc.). 3"x2" switch boxes, handy boxes or other reduced-size boxes are not permitted. One-piece, zinc-coated drawn steel, NEMA OS-1.
 - 2. Square boxes with rounded corners and no sharp, protruding edges.
 - 3. Knockouts on all four sides.
 - 4. Pre-drilled mounting holes, and ground wire screw holes.
 - 5. Raised device coverplates for switches or outlets, as required. T&B RS Series.
 - 6. Thomas & Betts, or equal.
- C. Surface mounted metal boxes for low voltage and power outlets:
 - 1. NEMA 1 smooth steel construction.
 - 2. Ivory finish to match surface raceway.
 - 3. Concealed knockouts for entry of surface raceway.
 - 4. No visible or open unused knockouts.
 - 5. Minimum 1-3/4" deep.
 - 6. Single or multi-gang box as required by drawings and application.
 - 7. Legrand Wiremold V57** Series, or equal.
- D. Surface mounted PVC boxes for low voltage and power outlets:
 - 1. NEMA 1 smooth PVC construction.
 - 2. Ivory finish to match surface raceway.
 - 3. Concealed knockouts for entry of surface raceway.

4. No visible or open unused knockouts.
 5. Minimum 1-3/4" deep.
 6. Single or multi-gang box as required by drawings and application.
 7. Legrand Wiremold 23** Series, or equal.
- E. Provide "stud-to-stud" or "dual box to stud" mounting brackets to ensure all adjacent boxes are level. Thomas & Betts, or equal
- F. Furnish all boxes with appropriate covers.
- G. No sectionalized boxes shall be used.

2.7 DWELLING UNIT DEVICE & OUTLET BOXES

- A. PVC Recessed Device boxes for use within Dwelling Units in conjunction with Type NM-B Cables:
1. NEMA 1 smooth PVC construction. NEMA OS-2.
 2. UL 514C Listed.
 3. Single or multi-gang box as required by drawings and application.
 4. Minimum 3-1/2"H x 2-1/2"D. 3-1/4"D for GFCI or AFCI receptacles.
 5. Old-work boxes, handy boxes or other reduced-size boxes are not permitted.
 6. Molded PVC or metal mounting bracket for use with metal stud construction.
 7. Knockout cable entry holes for NM-B cabling.
 8. T&B Carlon PVC New Work Box, or comparable product by Pass & Seymour, Raco.
- B. Metal Recessed Device boxes for use within Dwelling Units in conjunction with Type AC/MC Cables:
1. One-piece, zinc-coated steel, NEMA OS-1.
 2. Single or multi-gang box as required by drawings and application.
 3. Minimum 3-1/2"H x 2-3/4"D. 3-1/2"D for GFCI or AFCI receptacles.
 4. Old-work boxes, handy boxes or other reduced-size boxes are not permitted.
 5. Knockouts on all four sides and rear.
 6. Integral clamps for securing AC or MC cables.
 7. Pre-attached ground screw and bonding pigtail.
 8. Thomas & Betts, or comparable product by Pass & Seymour, Raco.
- C. Low Voltage Device Recessed PVC Mounting Brackets for use within Dwelling Units:
1. NEMA 1 smooth PVC construction. NEMA OS-2.
 2. UL 514C Listed.
 3. Single or multi-gang box as required by drawings and application.
 4. Minimum 3-1/2"H x 2"W, open back for LV cable entry.
 5. Molded PVC or metal mounting bracket for use with metal stud construction.
 6. Fold-out mounting "ears" are not acceptable.
 7. T&B Carlon PVC Low Voltage Backless Bracket, or comparable product by Pass & Seymour, Raco.
- D. Fire-Rated Non-Metallic Recessed Device boxes for use within fire rated walls/ceilings of Dwelling Units:
1. NEMA 1 smooth fiberglass reinforced plastic (FRP) construction. NEMA OS-2.

2. UL 514C Listed.
3. UL Listed for 2-hour fire resistance (marked on boxes)
4. Rated for wall (W), ceiling (C), or floor (F), as applicable.
5. Single, double, or triple-gang box as required by drawings and application.
6. Minimum 3-1/2"H x 2-1/2"D. 3-1/4"D for GFCI or AFCI receptacles.
7. Molded FRP or metal mounting bracket for use with metal stud construction.
8. Knockout cable entry holes for NM-B cabling.
9. UL listed for use in opposing walls with only 3" box separation.
10. Allied Molded Products *FiberglassBox*, Carlon PVC boxes, or comparable product by other manufacturer.

E. Surface mounted PVC boxes for low voltage and power outlets:

1. NEMA 1 smooth PVC construction.
2. White finish
3. No visible or open unused knockouts.
4. Single or multi-gang box as required by drawings and application.
5. Depth of box and extension ring if needed to meet the 24" reach range across counter.
6. Legrand WP3409, or comparable product by Leviton, Hubbell.

2.8 FIRE STOP PUTTY PADS FOR ELECTRICAL BOXES

- A. Moldable putty or putty pads to be used to seal around device or outlet boxes and/or cable penetrations, where installed in fire rated walls, ceilings or floors to maintain fire rating.
- B. Description:
1. Intumescent putty for up to 4-hour fire rating.
 2. Forms a continuous seal against fire, smoke, and hot gases.
 3. Available in bars or preformed pads.
 4. Remains pliable and workable for the lifetime of the installation.
 5. Acoustically tested.
 6. Will not harden over time.
- C. STI SpecSeal Putty and Putty Pads, or comparable product by 3M.

2.9 TELECOMMUNICATION OUTLET BOXES

- A. Back boxes:
1. Recessed outlets:
 - a. 4" x 4" x 2-1/2" deep steel, recessed device box.
 - b. Single-gang steel reducer plate (plaster ring).
 2. Surface mounted outlets in finished areas:
 - a. Single or multi-gang box as required by drawings and application.
 - b. NEMA 1 smooth steel construction.
 - c. Ivory finish to match surface raceways.
 - d. Concealed knockouts for entry of surface raceway.
 - e. No visible or open unused knockouts.
 - f. Minimum 1-3/4" deep.
 - g. Legrand Wiremold # V5748, or equal.
 3. Surface mounted outlets in unfinished areas:

- a. Single or multi-gang box as required by drawings and application.
- b. One-piece, zinc-coated drawn steel, NEMA OS-1.
- c. Square boxes with rounded corners and no sharp, protruding edges.
- d. Knockouts on all four sides.
- e. Minimum 1-3/4" deep.
- f. Thomas & Betts, or equal.

2.10 JUNCTION AND PULL BOXES

- A. Dry locations:
 1. 12-gauge galvanized sheet steel minimum.
 2. Flat covers secured in position by round head brass or stainless steel 300 grade machine screws.
 3. NEMA OS-1, "Sheet Steel Outlet Boxes, Covers and Box Supports."
- B. Exterior and wet locations:
 1. Cast aluminum or galvanized cast-iron type.
 2. Threaded hubs.
 3. Gasketed screw-on cover plates.
 4. NEMA FB-1, "Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies."
- C. Boxes imbedded in concrete:
- D. All boxes sized to meet the requirements of the NEC.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine areas to receive cable trays. Make adjustments to elevations, routing, etc. to coordinate with other work including beams, lights, ducts, pipes, etc.

3.2 APPLICATION

- A. General Interior Conduit Applications:
 1. All switchboard, panelboard or ATS feeders:
 - a. Above slab: EMT
 - b. Below floor slab: RGS, PVC*
 - 1) *RGS required where conduit penetrates through slab.
 - c. Below raised access floors: EMT
 2. HVAC equipment circuits:
 - a. (>30 amps): EMT
 - b. (≤ 30 amps): EMT, MC Cable
 - c. Below floor slab: RGS, PVC*

- 1) *RGS required where conduit penetrates through slab.
3. Branch circuits (lighting, receptacles):
 - a. Above accessible ceilings: EMT, MC Cable
 - b. Above inaccessible ceilings: EMT, MC Cable
 - c. Concealed in CMU walls: EMT, PVC
 - d. Within solid masonry walls: EMT, PVC
 - e. Concealed within stud walls: EMT, MC Cable
 - f. Surface mounted, finished areas: Wiremold *
 - 1) *Only with Architect's prior approval
 - g. Surface mounted, unfinished areas: EMT
 - h. Below raised floors: EMT, sealite
 - i. Surface mounted (kitchen areas): RGS
 - j. In or below slab on grade to flush floor boxes: PVC
4. Final Connections to Lights, dry transformers, small motors, vibrating equipment:
 - a. Indoor, dry locations: Greenfield
 - b. Outdoor, damp locations: Sealite

3.3 INSTALLATION

A. General:

1. Coordinate layout and installation of all raceways, cable trays, boxes and other equipment with other construction elements to ensure adequate headroom, working clearance, and access and to eliminate interference problems.
2. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
3. Do not cut or drill structural members without permission of Architect. Provide reinforcing for opening as directed by Architect.
4. Pierce metal deck where required for installation of electrical equipment.
5. Support raceways and equipment as required by NEC, manufacturers, and as specified elsewhere.
6. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer.
7. Tighten connectors and terminals, including screws and bolts, per manufacturer's published torque values, or per UL 486A, "Standard For Wire Connectors and Soldering Lugs for Use With Copper Conductors" where not specified.

3.4 CONSTRUCTION

- A. Flexible Connections: Use maximum of 6 feet of flexible conduit for connections to equipment subject to vibration, noise transmission, or movement, and for all motors. Use liquid tight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections. Provide flexible connections as follows:

1. Connections to motors between rigid conduit and connection box on motor.
2. Connections to equipment containing motors (power and control conduits).
3. Connections from rigid conduit system to recessed lights.
4. Other applications, as indicated.

3.5 CONDUIT INSTALLATION

A. General Installation Requirements:

1. Install all conduit concealed, unless not possible.

2. Surface mounting only as approved by Architect.
3. Minimum size 3/4" inch, unless noted otherwise.
4. Minimum 6" clearance from flues, heating pipes, or other hot surfaces above 80°F.
5. Parallel and perpendicular to walls, structural members, ceilings and interior surfaces; install plumb.
6. Polypropylene or nylon pull line in each empty conduit.
7. Use capped bushings or plugs during construction.
8. Clean and cap all conduits left empty for future use.
9. In masonry, install prior to wall construction and accurately set all outlets.
10. On walls below grade, use stand-off brackets. Maintain minimum 2" space between conduit and wall surface.
11. Where conduit passes through exterior walls, floor or roof, install appropriate fittings and materials to make openings watertight. Repair pierced vapor barriers vapor-proof. Provide flashing for each conduit piercing the roof.

3.6 DEVICE & OUTLET BOX INSTALLATION

A. General Requirements:

1. Install all boxes plumb and level.
2. Install boxes at heights required. Refer to Section "Wiring Devices."
3. Install recessed boxes flush with final finished surface.
4. Secure all boxes such that no movement occurs during normal use.
5. Install ceiling mounted boxes with sufficient support and rigidity to prevent movement during normal connecting and disconnecting procedures.
6. Install power and low voltage device boxes at same heights from floor or counters.
7. Consistent Mounting Heights: Provide installation of boxes at the same and consistent mounting heights throughout project. Where multiple switch boxes or power and low voltage boxes are installed in close proximity, use "stud-to-stud" or "dual box to stud" mounting brackets to insure all boxes are level.

B. Installation of Boxes in Fire Rated Demising Walls:

1. Where outlet or devices boxes are installed in fired rated walls, floors or ceilings, maintain the required fire rating by one or more of the following:
 - a. Metal boxes.
 - b. UL Listed non-metallic boxes with fire rating to match the wall, ceiling or floor fire rating.
 - c. Fire rated putty or putty pads to completely enclose the back side of box and all openings.
2. Low Voltage boxes in such locations shall use full enclosed boxes with putty pads, as required. Open mounting rings shall not be used in rated walls.
3. Where boxes of any type are used within the same stud cavity of rated walls, putty pads shall be used on the boxes in both sides of the rated wall, regardless of the box type or rating.
4. Where putty or putty pads are used, they shall complete engulf the entire back side of the box and seal all openings around cables and unused box knockouts or other voids.

3.7 REPAIR/RESTORATION

- #### A. Restore all finishes, equipment and surfaces to original condition, where affected by the

work of this section.

3.8 CLEANING

A. General:

1. Remove paint splatters and other spots, dirt, and debris.
2. Touch up scratches and marred finishes to match original finishes.
3. Clean front of all coverplates, etc. using methods and materials recommended by manufacturer.

END OF SECTION

SECTION 26 20 00

LOW VOLTAGE ELECTRICAL DISTRIBUTION

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. Automatic Circuit Breakers
 - 2. Disconnect Switches
- B. Related Sections:
 - 1. Section "Common Work Results for Electrical" for concrete pads, bollards, labeling, and other general requirements.
 - 2. Section "Low Voltage Power Conductors and Cables" for 600V conductors.

1.3 SUBMITTALS

- A. Submittal Requirements of this section:
 - 1. Automatic Circuit Breakers & Enclosures
 - 2. Disconnect Switches
- B. Product data: Include dimensions, construction, materials, performance data, etc.
- C. Provide submittal data for each product type.
 - 1. To verify specifications have been met/exceeded.
 - 2. Independent laboratory test data where requested.
 - 3. Clearly indicate or state all options, etc.:
- D. Product Test Reports: Certified copies of manufacturer's design and routine factory tests required by the referenced standards.
- E. Closeout Submittals: Submit in accordance with the General Conditions and Division 01 requirements, Section "Common Work Results For Electrical", and as follows:
 - 1. All post-installation inspection checklists.
 - 2. Installer's pre-startup checklist.
 - 3. Post installation load test results.
 - 4. Preventative maintenance schedule for each unit.

1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms “Listed and Labeled”: As defined in the National Electrical Code, Article 100.
 2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.
 3. Where equipment consists of multiple components, the entire assembly or product shall be UL Listed and Labeled or Labeled by a testing organization acceptable to the Authority Having Jurisdiction per the NEC.
- B. Single-Source Responsibility:
1. The complete performance of assembled panelboards and/or switchboards, including all integral accessories, shall be the sole responsibility of the equipment supplier. It is the installer’s responsibility to ensure that all factory and field installed accessories and loose components used in the system, meet these specifications, and perform up to the stated and tested standards.
- C. Manufacturer/Vendor Requirements:
1. Coordinate the components of the system and their arrangements electrically and mechanically.
 2. Manufacturer shall be experienced in manufacturing equipment of the types and capacities indicated that have a record of successful in-service performance for a minimum of 10 years.
 3. Maintain, within 50 miles from site, a maintenance and service organization complete with parts inventory and repair facility. Service shall be available on a 24-hour basis.
 4. Start-up services and post installation tests, as specified.
 - 5.
- D. Installation Quality: In accordance with recognized trade organizations and standards.
1. ANSI American National Standards Institute
 2. ASME American Society of Mechanical Engineers
 3. ASTM American Society for Testing and Materials
 4. IEEE Institute of Electrical and Electronics Engineers
 5. IEEE C2 National Electrical Safety Code
 6. NEC National Electrical Code
 7. NECA National Electrical Contractors’ Association “*Standards of Installation*”
 8. NEMA National Equipment Manufacturers Association
 9. NETA National Electrical Testing Association
 10. NFPA National Fire Protection Association
 11. UL Underwriter’s Laboratories

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
1. Provide all transportation of equipment to site.
 2. Provide for rigging needed for unloading and setting large panels or switchboards into final position.
- B. Storage and Protection:

1. Where unit is to be installed indoors, without enclosure, store in covered building or offsite to prevent exposure to weather, etc.
2. Apply temporary heat according to manufacturer's recommendations within enclosure of each switchgear or switchboard section throughout periods during which equipment is not energized and is not under normal control of temperature and humidity.

1.6 PROJECT CONDITIONS

A. Electrical service to the facility:

1. 208Y/120 volt.
2. 120/240 volt.
3. 3 phase, 4 wire.
4. 1 phase, 3 wire.

1.7 SEQUENCING

A. General Sequencing:

1. Coordinate panelboard and switchboard installation with exterior and/or interior construction.
2. Provide for sub-grade or subslab roughins.
3. Coordinate construction of concrete pads with switchboard location.
4. Provide positioning and roughins such that required clearances are maintained after final installation.

1.8 WARRANTY

A. Special Warranty: Extended product warranties over and above that required by General Conditions of this contract. (Minimum Two Years)

1. Warranty shall be by the product manufacturer(s), as identified in each product specification.
2. Warranty includes all parts, labor, travel expenses, with no deductibles.
3. Installer/contractor shall complete and file all necessary documents with manufacturer, etc. to assure fulfillment of warranty requirements.
4. Deliver all extended warranty documents to Owner in O & M manuals with each product.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Available Manufacturers: Subject to compliance with requirements, provide a system by the named "Basis of Design" manufacturer, or a comparable product of one of the other following named manufacturers:

1. Automatic Circuit Breakers & Enclosures:
 - a. Square D/Schneider Electric (basis of design)
 - b. ABB (GE)
 - c. Eaton - Cutler-Hammer
2. Safety Disconnect Switches:
 - a. Square D/Schneider Electric (basis of design)

- b. ABB (GE)
- c. Eaton - Cutler-Hammer
- d. Menekes

2.2 AUTOMATIC CIRCUIT BREAKERS

- A. UL Listed, automatic circuit breakers for installation within panelboards and switchboards, or with enclosed cabinets and trim.
- B. Circuit breakers:
 - 1. Molded case, thermal magnetic, inverse time, unless noted otherwise.
 - 2. Adjustable magnetic trip settings for thermal-magnetic breakers ≥ 225 amps.
 - 3. Ratings as per drawings.
 - 4. Accessories, as noted.
 - a. Mechanical kirk key interlocking.
 - b. Shunt trip.
 - c. Under-voltage trip.
- C. Ground Fault Circuit Interrupter (GFCI) branch breakers:
 - 1. Installed in branch circuit panelboards and loadcenters where indicated.
 - 2. Single or two pole, per panel schedule.
 - 3. Class A protection, 6 mA trip for receptacle circuits.
 - 4. Equipment ground fault protection, 30mA trip for heat trace or other non-receptacle circuits.
- D. Arc Fault Circuit Interrupter (AFCI) branch breakers:
 - 1. Installed in branch circuit panelboards, where indicated.
 - 2. Arc fault sensing and circuit interruption, as required by NEC 210.12.

2.3 COMPACT, ROTARY HANDLE DISCONNECT SWITCHES

- A. Provide disconnect switches as shown on the drawings and where required by the National Electrical Code at under-sink instantaneous water heaters, etc.
 - 1. UL 508 Listed Motor Circuit Disconnect Switch, horsepower rated for motor applications.
 - 2. 240 or 480V rated, per application.
 - 3. Rated through 150 amps.
 - 4. Short circuit rated to 10kA Interrupting rating.
 - 5. Nylon enclosure, NEMA 4X for exterior, damp, or wet locations, on roof or on grade.
 - 6. Externally operated, rotary handle with all phases switched simultaneously.
 - 7. Padlock capable per OSHA regulations.
 - 8. Mennekes HDI Series, Square D MD Motor Disconnects, Mersen, or comparable product from named manufacturers.

2.4 SAFETY DISCONNECT SWITCHES

- A. Provide safety disconnect switches as shown on the drawings and where required by the National Electrical Code.
 - 1. Horsepower rated for motor applications.

2. Solid neutral terminals where applicable.
3. Shielded phase conductor terminals.
4. General duty type; 100kA Interrupting rating.
5. Enclosure ratings (unless indicated otherwise):
 - a. NEMA 1 for interior.
 - b. NEMA 3R for exterior, damp, or wet locations, on roof or on grade.
6. Cover interlock to prevent operation with cover open.
7. Rejection feature (Class R) fuses, for fused units.
8. Externally operated, with all current carrying parts silver or tin plated. Side handle, quick-make, quick-break operation.
9. Pad-lockable, minimum of 2.
10. Disconnects for boilers shall comply with ASME CSD-1-2012, "Controls & Safety Devices for Automatically Fired Boilers."
11. Square D, or comparable product by previously named manufacturers.

2.5 DWELLING UNIT EQUIPMENT DISCONNECT SWITCHES

- A. Provide safety disconnect switches as shown on the drawings in or external to dwelling units, and where required by the National Electrical Code for local disconnecting means for water heaters, AHU's, heat pumps, condensing units, etc.
 1. Horsepower rated for motor applications.
 2. Single-pole (120VAC) or 2-pole (240VAC) units, as required.
 3. Solid neutral terminals where applicable.
 4. Shielded phase conductor terminals.
 5. Light duty type; 22kA Interrupting rating.
 6. Enclosure ratings (unless indicated otherwise):
 - a. NEMA 1 for interior.
 - b. NEMA 3R for exterior, damp, or wet locations, on roof or on grade.
 7. Cover interlock to prevent operation with cover open.
 8. Non-fused or fusible per drawings. Plug fuses, for fused units.
 9. Externally operated. Side handle, quick-make, quick-break operation.
 10. Enclosure shall be pad-lockable, to prevent unauthorized access to energized components, per 2023 NEC 440.11.
 11. Square D Light Duty disconnect Switch, or comparable product by previously named manufacturers.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions: Examine the conditions under which the equipment shall be delivered, installed, and operated. Make all allowances required for operation, access and maintenance of the equipment, per Codes and manufacturers.

3.2 INSTALLATION

- A. General Requirements:
 1. Install all equipment, as indicated.
 2. Maintain minimum working space at live parts according to manufacturer's written instructions and NEC.
 3. Provide all required access space per NEC for controls, fuses and items requiring maintenance access.

B. Rough-in:

1. Roughin all underslab or below grade conduits, ducts, etc. prior to setting panels, switchboards or other equipment in place.
2. Coordinate exact stubups with proposed manufacturer's equipment installation drawings and the work of other trades in this contract.
3. Roughin for all required circuits, controls, connections, etc. as required by proposed equipment, even if not explicitly indicated on plans.
4. Make minor adjustments to locations so as to maintain required front working clearances and clearance above and below per NEC.

C. Circuit Breaker Installation:

1. Install circuit breakers in panelboards, or with enclosure, as required.
2. GFCI and AFCI circuit breakers: Provide circuits with dedicated neutral conductors. Connect neutral through breaker at panelboards, per manufacturer's instructions.
3. Provide labels on all protected outlet coverplates to indicate "GFCI PROTECTED" or "AFCI PROTECTED", as applicable.

3.3 CONSTRUCTION

A. Connections to Existing Work:

1. Provide connections between proposed distribution equipment and existing equipment:
 - a. Panelboards, switchboards, etc.

B. Interface with Other Work:

C. Grounding: Ground switchboards, panelboards, all metallic service and distribution equipment frames and enclosures per NEC and as specified in Section "Grounding & Bonding For Electrical".

D. Connections: Tighten joints, connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torque requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors," and 486B, "Wire Connectors for Use with Aluminum Conductors."

3.4 REPAIR/RESTORATION

A. Restore all finishes, equipment, surfaces and/or grade to original condition, where affected by the work of this section.

B. Comply with all requirements as specified in Section "Common Work Results For Electrical".

3.5 FIELD QUALITY CONTROL

A. General:

1. Perform inspections and testing to ensure installation complies with Contract

- Documents, is operational within industry and manufacturer's tolerances, is adjusted to specific project parameters, and is suitable for energizing.
2. Acceptance Testing: Provide for acceptance testing of electrical equipment specified in this section, as follows, and as required in Section "Common Work Results for Electrical".
 3. Schedule tests and provide notification at least one week in advance of test commencement.
 4. Provide a set of Contract Drawings to the testing agency.
 5. Provide manufacturer's installation and testing instructions to the testing agency.
 6. Provide complete shop drawing data on all equipment.
 7. Provide written results of all tests. Include date, equipment ID, name of testing company and technician, and results of each individual test. Provide pass/fail indication for each test.

B. Pre-Testing Inspections:

1. Inspect accessible components for cleanliness, mechanical, and electrical integrity, for presence of damage or deterioration, and to ensure removal of temporary shipping bracing. Do not proceed with tests until deficiencies are corrected.
2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, where not available, those of UL Standards 486A and 486B.
3. All settings, as specified in this section, shall be properly set and verified prior to equipment testing.

C. Acceptance Testing:

1. Switchboard and Panelboard Tests: After installing equipment, perform the following tests, at a minimum:
 - a. Perform insulation resistance tests, phase-phase and phase-ground for all buses and main breaker(s).
 - b. Perform continuity tests of all grounds, and bonded components.
 - c. Perform tests to confirm proper bonding of neutrals to ground, where intended.
 - d. Perform tests to confirm isolation of neutrals and grounds, except at intended locations.
 - e. Perform tests to confirm isolation of isolated grounds and equipment grounds, except at single intended location.
 - f. Perform overpotential tests per ANSI 37.20c.
 - g. Operation of auxiliary contacts and devices.
 - h. Operation of all gauges, displays and control equipment.

3.6 IDENTIFICATION

A. Identify all distribution system components and wiring in accordance with Section "Common Work Results For Electrical", and as follows:

1. Panelboards, switchboards, switchgear: Provide engraved nameplate for each equipment which identifies the equipment name per project nomenclature.
2. Fusible switches, enclosed breakers: Provide engraved nameplate for each disconnect which identifies the equipment served and the source of power to the device or equipment.
3. For each service entrance breaker, fused switch, panelboard, switchboard,

- switchgear, or similar equipment, provide an engraved nameplate which identifies the available fault current and the date for that data was calculated or obtained from the serving utility company, per NEC 110.24.
4. Meter Stacks: Provide an engraved nameplate for each meter stack main service breaker or fused switch, and for each dwelling unit meter & breaker identifying the apartment or dwelling unit served.

- B. Provide permanent warning signs on all electrical switchgear, switchboards, on electrical room doors, and on fenced yards containing such equipment. Warning signs shall be as specified in section "Common Work Results for Electrical".

3.7 ADJUSTING

A. General:

1. Set all field adjustable parameters to those as specified.
2. Set field adjustable pickup and time delay ranges of Ground Fault Systems and solid state breakers as indicated.

3.8 CLEANING

A. General:

1. Inspect interior and exterior of installed equipment and switchgear.
2. Remove paint splatters and other spots, dirt, and debris.
3. Touch up scratches and mars of finish to match original finish.
4. Remove protective films, etc. from all devices, controls, etc.
5. Remove debris, insulation and wire clippings, dirt, etc. from interior of all equipment.
6. Remove dirt, debris, etc. from top of all equipment.

3.9 DEMONSTRATION

- A. Owner Demonstrations: Provide a factory trained representative for each system and type of equipment, for the purpose of training owner's personnel:

1. Discuss proper operation, maintenance, and use of all equipment.
2. Demonstrate periodic Owner testing and/or inspection of equipment.
3. Demonstrate adjustment to Owner-accessible equipment and systems.
4. Instructors shall be fully knowledgeable of the installed equipment and all components.
5. Training shall be completed at the project site following Owner occupancy, at Owner's discretion.
6. Schedule after all final tests, adjustments and Owner's acceptance.
7. Training shall consist of a minimum of (4) hours of training and instruction, including use of delivered O&M manuals for each system or equipment.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. A/C switches.
2. Receptacles.
3. Connectors.
4. Device plates and covers.

- B. Related Sections:

1. Section "Common Work Results for Electrical."
2. Section "Low Voltage Electrical Power Conductors and Cables" for connecting wiring, cables and conductors.
3. Section "Raceways & Boxes for Electrical Systems" in which devices are to be installed.
4. Section "Lighting" for additional low voltage switches, occupancy sensor switches and dimming devices.

1.3 SUBMITTALS

- A. Submittal Requirements of this section:

1. A/C switches.
2. Receptacles.
3. Connectors.
4. Device plates and covers.

- B. Product data for each device type:

1. Manufacturer's specifications, data sheets.
2. Capacity ratings, NEMA configurations, etc.
3. Information required indicating contract compliance.
4. Device color.
5. UL Listing.

- C. Closeout Submittals: Submit in accordance with the General Conditions and Division 01 requirements, and Section "Common Work Results For Electrical".

1.4 QUALITY CONTROL

- A. Product Coordination Responsibility

1. The contractor shall insure that all proposed control and/or dimmer switches are fully compatible and matched with the proposed light fixtures.
2. Contractor shall confirm compatibility of proposed controls/switches with proposed lighting fixtures prior to submitting for approval or ordering.

1.5 DELIVERY, STORAGE AND HANDLING

A. Storage and Protection:

1. Deliver and store wiring devices and accessories according to manufacturers' instructions.
2. Do not store in unheated areas of high humidity, which might create corrosion or other deterioration.
3. Do not store in areas subject to high temperatures, which might cause deterioration or deformation of products.

1.6 SEQUENCING

A. General Sequencing:

1. Sequence installation of devices and equipment of this section such that damage to installed equipment is minimized.
2. Install device plates after all wall finishes have been completed.

B. Electrical Division Sequencing, Coordination, and Integration:

1. Provide installation of wiring devices after supporting raceways and boxes are permanently installed.
2. Provide coordination of proposed wiring devices with actual cord/plug requirements of attached equipment.
3. Match wiring devices to plug connectors for Owner-furnished equipment.
4. Match wiring devices to plug connectors for equipment furnished under other Divisions.
5. Do not install permanently wired flexible connectors and associated cables/service cords until attached equipment is in place.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Available Manufacturers: Subject to compliance with requirements, provide products by the named "Basis of Design" manufacturer, or a comparable product of one of the other following named manufacturers:

1. Switches & Receptacles:
 - a. Eaton Arrow-Hart Cooper
 - b. Hubbell
 - c. Leviton
 - d. Legrand Pass & Seymour

2.2 WIRING DEVICES - GENERAL

- A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices"

- B. Color: IVORY except as otherwise indicated or required by Code.
- C. UL Listed.
- D. All devices shall be of one manufacturer.
- E. Prewired pigtail connectors that accommodate Fed Spec receptacles, GFCIs and switches are approved. Must be crimped and welded terminal right angle application within the connector.
- F. Provide receptacles of tamper resistant (TR) construction in all of the following locations:
 - 1. All receptacles within dwelling units.
 - 2. Multi-family building spaces accessible to residents or public, including corridors, lobbies, and common areas.
 - 3. Any occupied building areas accessible to the public.
 - 4. Any exterior location accessible to the public.
 - 5. All receptacles in schools, preschools, daycares and educational facilities.
 - 6. All receptacles in medical offices including exam rooms, treatment rooms, waiting areas, restrooms, corridors.
 - 7. Residential care, nursing homes and assisted living facilities.
 - 8. Guest suites and rooms and common areas in hotels, motels and dormitories.
 - 9. Prison, jails and detention center areas accessible to prisoners or inmates.

2.3 A/C SWITCHES

- A. Toggle Switches:
 - 1. Silent mechanical type rated 20 ampere, 120/277VAC.
 - 2. Fed. Specification #WS896-E.
 - 3. 1-piece Lexan cam and toggle.
 - 4. 20 amp rating.
 - 5. Single pole, 3-way or 4-way, per drawings.
 - 6. Back and side wiring provisions.
 - 7. Arrow-Hart #1991 Series.
- B. Wall box Dimmer Switches:
 - 1. Vertical slide, preset type rated 20 ampere, 120/277VAC.
 - 2. Wattage rating as required.
 - 3. Adjustable low-end trim.
 - 4. Incandescent, low voltage or fluorescent application.
 - 5. Compatible with proposed fixtures, ballasts, etc.
 - 6. Single or 3-way operation in same switch.
 - 7. Toroidal RFI filtering.
 - 8. Separate on-off rocker switch.
 - 9. Acuity *Synergy* series, Prescolite *Element* series, Lightolier *Sunrise Preset*, Pass & Seymour *Titan Dimmer* series, or comparable product by other approved manufacturer.
- C. Wall box LED Fixture Dimmer Switches:
 - 1. Continuous, linear, flicker-free dimming from 100% - 1%.

2. Compatible with 0-10VDC and Phase-control LED drivers.
3. Vertical slide, preset type, 120/277VAC.
4. Rated 600 watts for Phase-control applications; 1000 watts for 0-10V applications.
5. Single or 3-way operation switches, as required.
6. Separate on-off rocker switch.
7. Acuity *Synergy* series, Hunt *Simplicity* series, Lutron, Leviton, P&S, or comparable product by other approved manufacturer

D. Wall box LED Fixture Universal Dimmer Switches (located in resident units):

1. Continuous, linear, flicker-free dimming.
2. Selectable forward or reverse phase control
3. Paddle on/off. Vertical dimmer slide
4. 120 VAC.
5. 450 watt maximum LED load.
6. Single or 3-way operation switches, as required.
7. Wattstopper Radiant, series, or comparable product by other approved manufacturer.

2.4 RECEPTACLES

A. Receptacles:

1. Construction, spec-grade (except devices within residential dwelling units).
2. Duplex NEMA 5-20R, 120 volt, 20 amp, 3 wire, U-ground.
3. UL 498 Listed.
4. Federal Specification #WS596-F.
5. Lexan or nylon body, metal yokes.
6. Arrow Hart #5362.

B. Tamper Resistant Duplex Receptacle (TR):

1. Duplex NEMA 5-20R, 120 volt, 20 amp, 3 wire, U-ground.
2. Dual spring-loaded shutters to block single object insertion into either H or N openings.
3. Nylon or lexan body.
4. NEC Article 517.18 compliant.
5. UL Listed as "Tamper Resistant" with identifying "TR" label.
6. Arrow Hart TR5362.

C. Ground Fault Interrupting (GFI) Receptacles:

1. Class A, UL943 listed, feed-thru type.
2. Screw terminal connections.
3. GFCI Receptacles shall have SafeLock protection. If critical components are damaged and ground fault protection is lost or if mis-wired, power to receptacle is disconnected.
4. End-of-life provision shall render outlet incapable of delivering power upon failure of GFCI function.
5. Reverse Line Mis-wire: receptacle shall not provide power if the hot and neutral wires are reverse wired.
6. Arrow-Hart #VGF20.

D. Ground Fault Interrupting Tamper-Resistant (GFI-TR) Receptacles:

1. Class A, UL943 listed, feed-thru type.
2. Screw terminal connections.
3. GFCI Receptacles shall have SafeLock protection. If critical components are damaged and ground fault protection is lost or if mis-wired, power to receptacle is disconnected.
4. End-of-life provision shall render outlet incapable of delivering power upon failure of GFCI function.
5. Reverse Line Mis-wire: receptacle shall not provide power if the hot and neutral wires are reverse wired.
6. NEC Article 517.18 compliant.
7. UL Listed as "Tamper Resistant" with identifying "TR" label.
8. Dual spring-loaded shutters to block single object insertion into either H or N openings.
9. Arrow-Hart #TRVGF20.

2.5 DWELLING UNIT WIRING DEVICES

A. Toggle Switches – Dwelling Units:

1. Silent mechanical type rated 15 ampere, 120VAC.
2. 1-piece Lexan cam and toggle.
3. Single pole, 3-way or 4-way, per drawings.
4. Back and side wiring provisions, with grounding screw/provisions.
5. Eaton (Cooper) 130* series, Hubbell RS*15 series, Legrand P&S 660 series, Leviton 265* series, or equal.

B. Countdown Timer Switches – For RESIDENT UNIT HEAT LAMPS:

1. Ratings: 120VAC, 1800 watts, resistance load.
2. 4 preset buttons for countdown period selection. Separate OFF button.
3. User selectable Time range buttons: 10-20-30-60 minutes
4. LED indicator lamp, - blinking for end of cycle.
5. Leviton Model LTB60-1LZ.

C. Tamper-Resistant (TR) Receptacles – Dwelling Units:

1. Duplex NEMA 5-15R, 120 volt, 15 amp, 3 wire, U-ground.
2. Back and side wiring provisions.
3. Dual spring-loaded shutters to block single object insertion into either H or N openings.
4. NEC Article 406 compliant.
5. UL Listed as "Tamper Resistant" with identifying "TR" label.
6. Arrow Hart TR270, Pass & Seymour TR5362, or equal.
7. Eaton (Cooper) TR270* series, Hubbell RR15S*TR series, Legrand P&S 3232TR series, Leviton T5320-S series, or equal.

D. Ground Fault Interrupting Tamper-Resistant (GFI-TR) Receptacles (Dwelling units):

1. Class A, UL943 listed.
2. 120VAC, 15 Amp rated. NEMA 5-15R.
3. Feed-thru type (20 Amp rated), where used to protect downstream outlets.
4. Screw terminal connections.

5. GFCI Receptacles shall have Safe-Lock protection. If critical components are damaged and ground fault protection is lost or if mis-wired, power to receptacle is disconnected.
6. End-of-life provision shall render outlet incapable of delivering power upon failure of GFCI function.
7. Reverse Line Mis-wire: receptacle shall not provide power if the hot and neutral wires are reverse wired.
8. Dual spring-loaded shutters to block single object insertion into either H or N openings.
9. NEC Article 406 compliant.
10. UL Listed as "Tamper Resistant" with identifying "TR" label.
11. Eaton (Cooper) TRSGF15 series, Hubbell GFTRST15 series, Legrand P&S 1597TR series, Leviton GFTR1 series, or equal.

2.6 CONNECTORS

A. Cord Receptacles & Connectors:

1. Spec grade, industrial duty, and impact resistant nylon construction.
2. High visibility yellow exterior.
3. Cord grip to prevent terminal strain.
4. Deep well wire terminals, captive brass screws.
5. Dead front, captive screws, NEMA configuration molded in.
6. Female: deep set, triple wipe brass contacts.
7. Males: Solid brass blades molded into body.
8. Leviton Industrial, or equal.

2.7 DEVICE PLATES & COVERS

A. Single and combination types that mate and match with corresponding wiring devices. Provide for every switch and outlet.

B. Interior Plate Finishes:

1. Finished Spaces:	Stainless steel, satin-finish, type 302, 0.04" thick.
2. Unfinished Spaces:	Galvanized steel.
3. Residential Units:	Lexan or nylon plate, color to match wiring devices.

C. Features include the following:

1. Plate-Securing Screws: Stainless steel, galvanized or colored, to match plate finish.
2. Arrow-Hart, Leviton, Pass & Seymour, or equal.

D. Weatherproof Covers:

1. Non-Metallic Damp & Wet Location Covers:
 - a. Non-metallic, polycarbonate.
 - b. Gasketed, self-closing.
 - c. Clear, hinged lift lid.
 - d. Weatherproof during operation per NEC
 - e. Eagle WeatherBox, Pass & Seymour, or equal.
2. Metallic Damp & Wet Location Covers:
 - a. Cast, copper-free aluminum construction.

- b. Gasketed, self-closing.
- c. Hinged lift lid, with stainless steel spring & pin.
- d. Each half of duplex cover hinged separately.
- e. Appleton, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. General Requirements:

- 1. Install all equipment plumb and level.
- 2. Install devices tight to boxes, etc. such that no movement occurs during normal connecting and disconnecting procedures or operation.
- 3. Install coverplates tight to surrounding surface. Coverplate shall not provide the only means of support for wiring devices.
- 4. Where multiple devices are installed at the same location and elevation, use a single, multi-gang box and single cover plate, as applicable.
- 5. Do not install receptacles directly behind any sinks, or within 36" of showers or bathtubs.
- 6. Where wiring devices, such as occupancy, dimmer, timer or other control switches, require a grounded conductor (neutral) connection for operation, install neutral conductor to the mounting box. Do not connect device neutral to equipment ground wire.
- 7. Where standard toggle switches are installed serving lighting loads in areas described in NEC 404.2(C), provide a grounded conductor (neutral) to the switch device box location as specified. Do not connect device neutral to equipment ground wire.

B. Rough-in: Unless noted otherwise, the following mounting heights shall be used:

- 1. Wall receptacles: 18" AFF to center.
- 2. Wall switches: 48" AFF to center.
- 3. Exterior receptacles: 24" above grade.

C. Wallbox Dimmer Switches:

- 1. Install wallbox dimmer switches per manufacturer's instructions.
- 2. Mount cooling fins per manufacturer, if applicable.
- 3. Install adjacent switches in individual back boxes, and with required spacing for proper operation and cooling.

D. Identification:

- 1. Permanently identify all general-purpose and dedicated equipment receptacles in all spaces in accordance with the project nomenclature.
 - a. At every receptacle, identify source panel and circuit number (i.e. RP1-12) via machine printed label (i.e. Brother P-Touch, or equal) applied at top of cover plate. Printing shall be black, minimum 1/4" high text. Label shall be visible with plug installed, as practicable.

3.2 REPAIR/RESTORATION

- A. Restore all finishes, equipment and surfaces to original condition, where affected by the

work of this section.

3.3 RE-INSTALLATION

- A. Reinstall all outlets, coverplates and similar devices, where removed to accomplish the work of these documents.
- B. Where the devices are damaged during removal or reinstallation, replace with new devices of similar quality, color, etc. to existing.

3.4 CLEANING

- A. General:
 - 1. Clean all construction debris from within outlet boxes, prior to close-up.
 - 2. Remove all paint, joint compound and other marks from devices and coverplates.

END OF SECTION

SECTION 26 50 00

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. Lighting fixtures
2. LED Modules & Drivers
3. Occupancy sensors

- B. Related Sections:

1. Section "Common Work Results for Electrical" for labeling and other general requirements.
2. Section "Grounding & Bonding for Electrical Systems" for grounding and bonding requirements.
3. Section "Low Voltage Power Conductors and Cables" for 600V conductors.
4. Section "Raceways and Boxes for Electrical Systems" for conduit and raceway connections.
5. Section "Wiring Devices" for switches, wallbox dimmers, etc., and for receptacles controlled by occupancy (plug-load) control sensors.

1.3 REFERENCES

- A. ANSI

1. ANSI C78.377 Specifications for the Chromaticity of Solid State Lighting Products

1.4 SYSTEM DESCRIPTION

- A. Performance Requirements: Performance of the lighting fixtures and controls is based on the specified and/or indicated products. It is the full responsibility of the installer to ensure that any differences in products do not deviate from the intended design or performance.

1.5 SUBMITTALS

- A. Submittal Requirements of this section:

1. Individual lighting fixtures.
2. LED Modules/Drivers
3. Energy Star compliance for exit lights & selected fixtures
4. Emergency battery inverters.
5. Occupancy sensors.
6. Certain fixtures have been selected based not only on performance, but on

appearance, finish, shape, etc. Any substitutions shall be equal in performance and construction, as well as in appearance, as judged by the Owner or Architect. Where no equals are available, as determined by the Architect, submit the specified fixture.

B. Descriptive Data:

1. Manufacturer's specifications, data sheets.
2. Catalog cuts.
3. Dimensional drawings.
4. Installation Instructions.
5. Wiring & connection diagrams.
6. Capacity ratings, performance curves.
7. Information required to indicate contract compliance.
8. Clearly indicate and/or mark options, etc.:
 - a. Manufacturer/cat. number.
 - b. Energy Star ratings.
 - c. Design Light Consortium (DLC) compliance/listing.
 - d. LED lamp input wattage, lumen output and color temperature (K).
 - e. Coefficient of Utilization (C.U.) charts.
 - f. Construction data, materials, lens type, reflector material, housing, as applicable.
 - g. Warranty data.
 - h. Color charts, where applicable.
 - i. Fixture samples when requested.

C. Wiring Diagrams:

1. Occupancy sensors and controls.
2. Low voltage control systems.
3. Low voltage contactor panels.

D. Shop Drawings:

1. Digital lighting management systems.
2. Low voltage contactor/control panels.

E. Samples:

1. Provide fixture samples, when requested.
2. Sample shall be identical to the proposed fixture in color, lamp, physical size, etc.
3. Sample shall have a cord and plug, for connection to 120V, 20A wall receptacle.

F. Closeout Submittals: Submit in accordance with the General Conditions and Division 01 requirements, Section "Submittals", and as follows:

1. Control system programming, setup and user controls.

1.6 ELECTRONIC AUTOCADD DOCUMENTS

- A. Requests for electronic Autocadd documents will be accommodated to the contractors and installers upon receipt of Kibart's Electronic Document Release Form. Refer to Section "Common Work Results for Electrical" for additional information.

1.7 QUALITY ASSURANCE

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms “Listed and Labeled”: As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A “Nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.
 - 3. Where equipment consists of multiple components, the entire assembly or product shall be UL Listed and Labeled, or Labeled by a testing organization acceptable to the Authority Having Jurisdiction per the NEC.
- B. Single-Source Responsibility
 - 1. The complete performance of the assembled fixtures, mounts, poles, etc. including all accessories shall be the sole responsibility of the supplier. It is the installer’s responsibility to ensure that all factory and field installed accessories and loose components used in the system, meet these specifications, and perform up to the stated and tested standards.
 - 2. Ensure that the complete fixture assembly complies with all individual component specifications, including LED’s, drivers, etc.
 - 3. Pole mounted fixtures: The manufacturer shall be responsible for the proper fit and performance of the fixture and pole, including attachment hardware, support arms, etc.
- C. Manufacturer/Vendor Requirements:
 - 1. Fixture manufacturer(s) shall have a minimum 15-year record of fixture manufacturing and in-service products of similar construction in the North American market.
 - 2. All fixtures shall be domestically manufactured. Off-shore manufactured/assembled, imported fixtures are NOT permitted.
 - 3. Ballast manufacturers shall have a minimum of 15 years of producing electronic ballasts for the North American market. Manufacturers shall be certified to ISO 9001 Quality System Standards.
 - 4. Furnish lighting fixtures indicated, complete with LED’s, drivers and mounting and/or suspension hardware.
 - 5. Furnish interior lighting fixtures with proper trim kits, framing kits, supports, etc.
 - 6. Drawing fixture schedule generally indicates required features and/or performance. Manufacturers’ catalog numbers are noted for reference and may not include all suffixes and prefixes of required features. Provide fixtures with all the features of the base catalog number provided and all additional options indicated.
 - 7. Verify that proposed controls, dimming and other components which are to interface with the fixtures, drivers, etc. are fully compatible with the fixture, ballast or driver manufacturers’ written instructions.
 - 8. LED source manufacturers shall provide testing in accordance with LM-80. Along with a valid method of projecting LM-80 test results to L50 & L70 lumen maintenance values based on recommended operating conditions.
 - 9. LED fixture manufacturers shall perform their own of junction temperature, drive current and other relevant factors and base the fixtures L50 & L70 values on LM-80 extrapolations provided by the LED source manufacturer.

10. LED fixture manufacturers shall base published photometric data on test results from an independent NI ST – traceable testing lab using photometry in accordance with LM-79.

D. Product Coordination Responsibility

1. The contractor and equipment vendor(s) shall insure that all proposed fixtures are fully compatible and matched with the proposed switches, lighting controls, dimmers and related lighting control components.

E. Installer Qualifications:

1. Experienced in the installation and connection of all proposed fixture types, control components, and all other specified equipment.

F. Installation Quality: In accordance with recognized trade organizations and standards.

1.	ANSI	American National Standards Institute
2.	ASME	American Society of Mechanical Engineers
3.	ASTM	American Society for Testing and Materials
4.	IEEE	Institute of Electrical and Electronics Engineers
5.	NEC	National Electrical Code
6.	NECA	National Electrical Contractors' Association "Standards of Installation."
7.	NEMA	National Equipment Manufacturers Association
8.	NETA	National Electrical Testing Association
9.	NFPA	National Fire Protection Association
10.	UL	Underwriter's Laboratories

1.8 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading:

1. Provide all transportation of unit(s) to site.
2. Provide for rigging needed for unloading poles/crossarm assemblies, and other large equipment, and setting into final position.

B. Storage and Protection:

1. Store all fixtures in original packaging, as recommended by manufacturer.
2. Store all fixtures in covered storage or building, out of the weather, until installation.
3. Protect from physical damage and deterioration from heat, moisture, etc.
4. Do not store electronic or sensitive components (i.e. occupancy sensors, control systems, etc.) in areas of high heat or humidity, which might create corrosion or other deterioration.
5. Store poles in horizontal position, on-grade with proper supports to prevent sagging and scratches.

1.9 PROJECT CONDITIONS

- A. Fire Rated Ceilings: Fixtures shall be compatible with ceiling or ceiling assembly fire rating per Architectural drawings. Provide UL Listed fixtures rated for the UL ceiling assembly or provide tenting of light fixtures with UL rated enclosures to maintain fire

rating of ceiling. Refer to Architectural drawings and specifications for locations and rating requirements.

1.10 SEQUENCING

A. General Sequencing:

1. Coordinate layout and installation of fixtures with other installations.
2. Provide input to coordinated construction layout drawings to ensure fixtures are installed as designed. Revisions to locations and elevations from those indicated shall be made only after consulting the Engineer/Architect, as required to suit field conditions and as approved by the Owner.
3. Coordinate actual fixture depths and locations with piping, ductwork, cable trays, bulkheads, and other ceiling mounted equipment, etc. prior to rough-in.

1.11 WARRANTY

A. Special Warranty: Extended product warranty over and above that required by the Contract and General Conditions of this contract.

1.	LED fixtures (complete assembly):	3 years
2.	Occupancy sensors & switches:	5 years
3.	Digital and low voltage switches:	5 years

1.12 SYSTEM STARTUP

A. Manufacturer's Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of the following system, associated components and accessories, and the pretesting, programming and/or adjustment of all settings, components and accessories.

1. Low voltage control systems.
2. Digital lighting management systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, provide the named "Basis of Design" manufacturer and model ("Basis of Design" fixtures are indicated on the drawing fixture schedule), or a comparable product of one of the other following named manufacturers:

1. Interior Lighting Fixtures:
 - a. Lithonia Lighting
 - b. Pinnacle Lighting
 - c. Spectrum Lighting
 - d. Elite Lighting
 - e. Visa Lighting
 - f. Alphabet Lighting
 - g. Emergilite
 - h. Columbia Lighting
 - i. Cooper Lighting
 - j. Kenall Lighting

- k. Daybrite Lighting
- l. Finelite, Inc
- m. Ledalite
- n. Focal Point Lighting
- o. New Star
- p. Current Lighting
- q. H.E. Williams
- 2. Residential Unit Lighting Fixtures:
 - a. Seagull Lighting
 - b. Efficient Lighting
 - c. Philips/Lightolier
 - d. Progress Lighting
- 3. LED Modules & Drivers:
 - a. Philips Advance
 - b. CREE
 - c. Samsung
- 4. Occupancy Sensors & Switches:
 - a. LeGrand - Watt Stopper
 - b. Sensor Switch
 - c. Hubbell
 - d. Leviton

2.2 GENERAL REQUIREMENTS

A. Listing/Labeling:

- 1. UL listed and labeled fixtures and wiring.
- 2. UL Damp or Wet location listed, as indicated or required.
- 3. UL hazardous area listed for Class, Division, and Group.

B. Mounting Accessories:

- 1. Fixture schedule generally indicates catalog number for lay-in tile ceilings.
- 2. Refer to Architectural drawings for ceiling types.
- 3. Provide fixture surface mounting kits, recessed framing kits, hardware, supports, hangers, etc., as required.

2.3 CONSTRUCTION FEATURES

A. LED Fixtures:

- 1. LED light source shall be shielded from direct view (interior fixtures).
- 2. One piece die-cast housing designed specifically for LED lamps/drivers.
- 3. Thermal control to ensure cool running LED's.
- 4. All LED fixtures shall have a similar color temperature (degree K) rating to prevent visible lamp color differences.
- 5. Replaceable LED module and driver.
- 6. All LED fixtures, modules and drivers shall be RoHS compliant.

2.4 LED MODULES & DRIVERS

A. Minimum Requirements:

- 1. U.L. Listed.
- 2. High Efficiency, solid state driver.

3. Minimum rated life of 50,000 hours at 70%.
4. 3500K color temperature, unless otherwise noted or specified.
5. CRI of 80 (minimum).
6. RoHS compliant.
7. Dimmable and compatible with all 0-10V dimming switches.
8. Philips Xitanium drivers, or approved equal.
9. All LED fixtures shall be supplied with integral or external/remote drivers. Where LED fixtures do not have integral driver(s), provide required LED driver(s) as recommended by the LED manufacturer, matching all operational requirements of the LED lamps, modules, etc.

B. Construction Features:

1. Driver shall include all metal-can construction for optimal thermal performance.
2. Driver shall operate from 50/60 Hz input source of 120V through 277V with sustained variations of +/- 10% (voltage) with no damage to the Driver.
3. Output shall be regulated to +/- 5% across published load range.
4. Minimum input Power Factor > 0.90 for 50-100% of full load.
5. Input current Total Harmonic Distortion (THD) < 20%.
6. Class A sound rating.
7. Minimum operating temperature of -4°F.
8. Driver shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.
9. UL Listed for Damp and Dry locations.
10. Integral common mode and differential mode surge protection of 2.5kV(100kHz 30ohm ring wave).
11. Integral thermal fold-back to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.
12. Meets NEMA 410 for in-rush current limits.
13. Integral means of limiting surges to the LEDs.
14. Underwriters Laboratories (UL) recognized Class 2 per UL1310.
15. 5-year limited warranty from date of manufacture against defects in material or workmanship, including replacement.
16. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller with dimming range controlled between 1 and 8VDC with source current 150µA.

C. Outdoor LED Driver Construction Features:

1. Integral common mode and differential mode surge protection of 3kV (1.2/50µs, 2ohm combination wave).
2. Minimum operating temperature of -40°F.

2.5 LINE VOLTAGE OCCUPANCY SENSORS

A. Device Color: WHITE except as otherwise indicated.

B. Sensor requirements:

1. 120V or 277V operation, as applicable.
2. Sensitivity adjustment with LED for calibration.
3. Manual-On control of load(s) per latest IECC requirements.
4. 5 year warranty from manufacturer.

5. Adjustable sensitivity and time delay settings.

C. Wall Switch PIR Sensor:

1. Passive infrared.
2. 180° coverage.
3. Coverage: 900 sq. ft. maximum, 300 sq. ft. for desktop activity.
4. Maximum load; 800W @ 120V, 1200W @ 277V.
5. 2 level, 36 segment fresnel lens.
6. Button(s) for Manual-On of load(s) in compliance with IECC.
7. 2-Relay switches with two individual manual buttons for dual-circuit lighting, bi-level lighting, or lighting & plug-load controls, where indicated.
8. WattStopper PW-100 (single circuit) or PW-200 (dual circuit) series, Hubbell, or approved equal.

D. Wall Switch Ultrasonic Sensor:

1. Ultrasonic sensing.
2. 180° coverage.
3. Coverage: 400 sq. ft. maximum, 225 sq. ft. for desktop activity.
4. Maximum load: 800W @ 120V, 1200W @ 277V.
5. 40kHz ultrasonic detection.
6. Button(s) for Manual-On of load(s) in compliance with IECC.
7. 2-Relay switches with two individual manual buttons for dual-circuit lighting, bi-level lighting, or lighting & plug-load controls, where indicated.
8. WattStopper UW-100 (single circuit) or UW-200 (dual circuit) series, Hubbell LightHAWK2, or approved equal.

E. Wall Switch Dual Technology Sensor:

1. Combination Passive Infrared and Ultrasonic sensing.
2. 180° coverage.
3. Coverage: 900 sq. ft. maximum, 300 sq. ft. for desktop activity.
4. Maximum load 800W @ 120V, 1200W @ 277V.
5. 2 level, 36 segment fresnel lens.
6. 40kHz ultrasonic detection.
7. Button(s) for Manual-On of load(s) in compliance with IECC.
8. 2-Relay switches with two individual manual buttons for dual-circuit lighting, bi-level lighting, or lighting & plug-load controls, where indicated.
9. WattStopper DW-100 (single circuit) or DW-200 (dual circuit) series, or approved equal.

F. Wall 0-10V Dimmer Switch PIR Sensor:

1. Passive infrared.
2. 180° coverage.
3. Coverage: 1000 sq. ft. maximum.
4. Maximum load (fluor); 1000W.
5. 2 level, 36 segment fresnel lens.
6. 0-10VDC dimming control.
7. Button(s) for Manual-On of load(s) in compliance with IECC.
8. Individual buttons for ON/OFF and UP/DOWN dimming control.
9. WattStopper PW-311 (single circuit), Hubbell, or approved equal.

G. Wall 0-10V Dimmer Switch Dual Technology Sensor:

1. Combination Passive Infrared and Ultrasonic sensing.
2. 180° coverage.
3. Coverage: 900 sq. ft. maximum, 300 sq. ft. for desktop activity.
4. Maximum load 800W @ 120V, 1200W @ 277V.
5. 2 level, 36 segment fresnel lens.
6. 40kHz ultrasonic detection.
7. 0-10VDC dimming control.
8. Button(s) for Manual-On of load(s) in compliance with IECC.
9. Individual buttons for ON/OFF and UP/DOWN dimming control.
10. WattStopper DW-311 (single circuit) series, Hubbell, or approved equal.

H. Ceiling Mounted Dual Technology Sensor:

1. Dual PIR and Ultrasonic sensing.
2. Universal wall/ceiling mounting bracket.
3. Coverage: DT-200 (2000sf @ 10' mtg height); DT-300 (1200sf @ 8' mtg height).
4. Complete with power pack, relays.
5. Internal auxiliary contact for misc. functions.
6. Ganging of 1-3 sensors per power pack for large areas.
7. Adjustable 3-430 fc daylight sensor to maintain illumination (remains off when above set fc level).
8. WattStopper DT-200 (wall) or DT-300 (ceiling) , Hubbell OMNI, or approved equal.

2.6 LOW VOLTAGE CONTROL CABLING

- A. Cables for low voltage dimming or control systems shall be as recommended by the control system manufacturer.
- B. All low voltage cabling installed on this project shall be UL Listed, plenum rated cable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions: Examine the conditions under which the equipment shall be delivered, installed, and operated. Make all allowances required for operation, access and maintenance of the equipment, per Codes and manufacturers.

3.2 BALLAST & LAMP DISPOSAL

- A. General:
1. Provide all labor, materials, equipment, transportation, documentation and services necessary for the proper removal and disposal of all fluorescent ballasts and lamps removed with or from the existing lighting fixtures.
 2. Contractor is responsible for legal and proper disposal and associated costs for transportation, containers, landfilling, etc. as may be required.

3.3 INSTALLATION

- A. Fixture Installation - General:

1. Provide even, symmetrical spacing of fixtures.
2. Coordinate with diffusers, grilles and access panels in ceilings to establish a symmetrical pattern.
3. Support all fixtures independent of ceiling systems, ducts and piping.
4. Provide hangers from purlins, joists, beams, etc., for support of all boxes and fixtures.
5. Provide trapeze hanger supports for fixtures under ducts, large pipes, etc.
6. Galvanized steel for all hangers, channels, bolts, etc.
7. No fixtures shall be supported solely by grid or gypsum board ceilings.
8. Maintain required clearances around fixtures according to manufacturer's written instructions.
9. Drawings are general in nature and show approximate mounting locations of fixtures. Follow spacing dimensions, where indicated on architectural or reflected ceiling plans.
10. Coordinate exact roughins during construction to center and align fixtures, as applicable.
11. Coordinate wall mounted fixtures with other wall materials and items (TV/monitors, fire alarm devices, downspouts, etc.).

B. Recessed Fixtures:

1. Support recessed fixtures with galvanized tie wires, at two opposite corners of fixture.
2. Provide framing for all recessed fixtures.
3. Plaster frames for plaster or GWB ceilings.
4. Provide sloped ceiling adapters, where applicable.
5. Make electrical connections using flexible conduit, concealed above finished ceilings.

C. Surface Mounted Fixtures:

1. Install fixtures tight to ceiling or wall surface with no visible gaps.
2. Support fixture using rigid rods, channels, etc. Do not support from ceiling grid system or with wires.
3. Tighten attaching hardware evenly and per manufacturer's instructions to prevent warping or distortion of fixtures.
4. Provide recessed backbox to allow fixture mounting tight to surface.
5. Make electrical connections through rear of fixture, concealed as practicable.

D. Suspended Fixtures:

1. Provide hangers, rods, suspension cables, etc. for suspended fixtures, per drawings.
2. Install fixtures level and will all support rods or cables plumb.
3. Securely attach fixture to rigid supports, where applicable, to prevent wobble.
4. For continuous row fixtures, install rows straight and level. Provide supports at intervals, per manufacturer.
5. Make electrical connections from above, through top of fixture(s). Minimize visible cable or hollow rod wiring drops by using through-wiring of continuous row fixtures, as permitted by manufacturer.

E. Occupancy/Vacancy Sensor Installation:

1. Install in ceiling or wall, per actual manufacturer's instructions. Drawings are not to be used for exact placement.
 2. Infrared sensors:
 - a. Position sensor for optimal coverage and sensing within the control zone, per manufacturer's instructions.
 - b. Locate so that sensors are not aimed directly through normally open doorways, cased openings, etc.
 - c. Do not aim sensing elements at open doors or windows.
 - d. Provide masking of IR coverage pattern to avoid detection outside the control zone.
 - e. Maintain maximum distance from heating registers, convectors, unit heaters, and other moving hot air sources.
 3. Ultrasonic sensors:
 - a. Position sensor for optimal coverage and sensing within the control zone, per manufacturer's instructions.
 - b. Locate so that sensors are not aimed directly through normally open doorways, cased openings, etc.
 - c. Maintain maximum distance from air devices, and other sources of moving air.
 - d. Do not aim sensing elements at open doors or windows.
 4. Wall PIR Sensor Switch:
 - a. Position sensor on wall for optimal coverage of the room control zone, per manufacturer's instructions.
 - b. Locate so that sensors are not aimed directly through normally open doorways, cased openings, etc.
 - c. Do not place sensors on walls perpendicular and distant from the main room activity (ie an office desk area).
 - d. Provide masking of IR coverage pattern to avoid detection outside the control zone.
- F. Control Switches, Devices and Occupancy Sensor Switch Installation:
1. Install all equipment plumb and level.
 2. Install devices tight to boxes, etc. such that no movement occurs during normal operation.
 3. Install cover plates tight to surrounding surface. Cover plate shall not provide the only means of support for wiring devices.
 4. Where multiple devices are installed at the same location and elevation, use a single, multi-gang box and single cover plate, as applicable.
 5. Where wiring devices, such as occupancy, dimmer, timer or other control switches, require a grounded conductor (neutral) connection for operation, install neutral conductor to the mounting box. Do not connect device neutral to equipment ground wire.
 6. Where standard toggle switches are installed serving lighting loads in areas described in NEC 404.2(C), provide a grounded conductor (neutral) to the switch device box location as specified. Do not connect device neutral to equipment ground wire.
 7. Match the rough-in heights of similar wiring devices in the project. Unless noted otherwise, the following mounting heights shall be used:
 - a. Line and Low Voltage wall switches: 48" AFF to center.
 - b. Occupancy sensor switches: 48" AFF to center

3.4 CONSTRUCTION

- A. Grounding: Ground fixtures, housings, poles, and supporting equipment frames and enclosures per NEC and as specified in Section “Grounding & Bonding For Electrical Systems.”
- B. Connections: Tighten joints, connectors and terminals, including screws and bolts, in accordance with manufacturer’s published torque tightening values for connectors and bolts. Where manufacturer’s torque requirements are not indicated, tighten connections to comply with torque tightening values specified in UL 486A, “Wire Connectors and Soldering Lugs for Use with Copper Conductors”.

3.5 REPAIR/RESTORATION

- A. Restore all finishes, equipment and surfaces to original condition, where affected by the work of this section.

3.6 RE-INSTALLATION

- A. General: Provide for reinstallation of all existing fixtures relocated or temporarily removed and reinstalled by this contract.
 - 1. Thoroughly clean each fixture as specified in paragraph “Cleaning.”
- B. Where the fixtures are damaged during removal or reinstallation, replace with new fixtures, lenses, louvers, as required, with components of similar quality, color, etc. to existing.

3.7 ADJUSTING

- A. General:
 - 1. Adjust aiming of all fixtures with adjustable optics or housings.
 - 2. Rotate downlight trims for proper orientation of louver blades or wall wash reflectors.
- B. Occupancy Sensor Adjustments:
 - 1. Provide masking or blocking of PIR sensors and wall switches, as required to limit sensitivity to within the intended room/area only.
 - 2. Provide field adjustments to sensitivity and range, appropriate to the activity planned in the area, coverage area, etc.
 - 3. Provide shielding to limit sensitivity to nearby illumination sources, as required.
 - 4. Re-adjust any sensors for improved operation per Owner direction.
 - 5. Adjust footcandle level settings for sensors with daylight sensing.
 - 6. Set “Time Delay Off” adjustments, as follows:
 - a. Other areas not listed: 20 minutes

3.8 CLEANING

- A. General: Clean all fixtures after work of all trades is complete, and prior to turnover to Owner.
 - 1. Remove paint splatters and other spots, dirt, and debris.
 - 2. Touch up scratches and mars of finish to match original finish.
 - 3. Remove protective films, etc. from all devices, controls, etc.

4. Remove all wire clippings, etc. from interior of fixtures.
5. Adjust louvers, shielding, etc. for proper and consistent orientation.
6. Thoroughly wipe clean all surfaces with degreaser/cleaner, suitable for material.
7. Leave no visible dirt or fingerprints on lenses, louvers, housings, reflectors, lamps, etc.

3.9 DEMONSTRATION

A. Owner Demonstrations: Provide a factory trained representative for each system and type of equipment, for the purpose of training owner's personnel:

1. Discuss proper operation, maintenance, and use of all equipment.
2. Demonstrate periodic Owner testing and/or inspection of equipment.
3. Demonstrate adjustment to Owner-accessible equipment and systems.
4. Instructors shall be fully knowledgeable of the installed equipment and all components.
5. Training shall be completed at the project site following Owner occupancy, at Owner's discretion.
6. Schedule after all final tests, adjustments and Owner's acceptance.
7. Training shall include use of delivered O&M manuals for each system or equipment.

B. Occupancy Sensor Demonstration:

1. Provide working demonstration for each type of sensor installed.
2. Explain function, delay settings, adjustments, etc.

END OF SECTION

SPECIAL PROVISIONS

Builder's Risk Insurance

- A. The Contractor shall, at his/her own cost, insure the work and keep it insured at all times during the period of construction, and until final acceptance of it by the County against loss of damage covered by an "All Risk" Builders Risk type of policy. The amount of insurance shall be the 100% estimated replacement cost of the work.
- B. The policies shall be made payable to the County and the Contractor, as their interest may appear, and the policies shall be left in the possession of the Engineer, prior to the start of construction.

S E C T I O N I I I

Permits

N/A

SECTION I V

Proposal

**This Section to be
Completed by Time of Bid**

SECTION-IV
PROPOSAL

DESCRIPTION OF WORK

Bid Opening via Teleconference WebEx: Thursday, January 22, 2026 @ 10:45 a.m. EST.
WebEx Phone Number 1-415-655-0001, Access Code Number 2316 465 1569##.

Begin Work Within Fifteen (15) Days After NOTICE TO PROCEED

Calendar Days for Completion: Three Hundred (300)

Liquidated and Other Damages: FIFTEEN HUNDRED DOLLARS (\$1500.00 PER CALENDAR DAY)

Cost Group "C" (\$500,001 to \$1,000,000) (Prequalified contractors with a Cost Group restriction must bid within the dollar amount stated on their Certificate of Prequalification)

Work Classification: I3

TO BALTIMORE COUNTY, MARYLAND: The Arts Center, constructed around 1900, and log cabins, believed to be constructed in the 1930s, are historic and should be preserved to the greatest extent possible. New materials used for repairs and renovations will be carefully selected to match or coordinate with the existing historic fabric. The design team is recommending minimal interventions in order to minimize the impact on the historic character of the cabins. The Arts Center scope includes renovations to the Greenhouse and repairs to the brick pavers. The Garden Cabin scope includes a new ADA restroom addition to the north side of the cabin, replacing the exterior wood siding with cement siding, and other minor repairs and upgrades. The Nature Cabin scope includes reconstruction of the front porch as well as other structural repairs, replacing the exterior wood siding with cement siding, and interior casework. The 112 McCormick Avenue Cabin scope includes renovations to raise the floor in the existing Kitchen area and reconfiguration of the addition to provide an ADA restroom. The Garage scope includes sealing of the concrete slab and storage shelving. Overlea - District 14c6.

The following listed Drawing Number(s) are collectively the "Drawings", and are hereby incorporated in the Contract.

<u>Workday Number</u>	<u>Drawing Number(s)</u>
10001017	2025-1535 thru 1588

A pre-bid meeting will be held on Wednesday, January 7, 2026 at 10:00 a.m. EST via WebEx. *Phone-In (Audio Only)* – 1-415-655-0001, Meeting Number 2317 118 8593##. *Video Conference* – Meeting Number 2317 118 8593, **Password: bEuMYWCT782**, go to <https://signin.webex.com/join>, or for the WebEx link go to www.baltimorecountymd.gov/departments/public-works/engineering/contracts/current-solicitations

NOTE: No successful bidder may withdraw their bid within NINETY (90) days after the opening thereof.

The Contractor hereby declares that it has carefully examined the solicitation, plans and specifications, form of contract, Special Provisions and Drawings (collectively the "Contract Documents"). The Contractor also hereby declares that it has carefully examined the September 2023 "Standard Specifications for Construction and Materials" and "Standard Details for Construction", collectively the "Applicable County Law" and any and all Department of Public Works and Transportation revisions thereto as of the date of advertisement. The Contract Documents, the Applicable County Law and the Department of Public Works and Transportation revisions thereto are collectively the "Specifications" and are incorporated herein. Copies of any and all Department of Public Works and Transportation revisions including but not limited to the General Conditions Building Projects, are available online at www.baltimorecountymd.gov/departments/public-works/standards. Also, the Contractor has, to its satisfaction, examined the locality of the proposed work and agrees to furnish all labor, tools, materials, machinery, equipment, and other means of construction called for in the manner provided in the Specifications for the prices shown on the next page(s) and as evidenced by Contractor's signature on the last page thereof.

SCHEDULE OF PRICES

NOTE: The Bidder shall fill out this Proposal, write in the unit prices in clear numerals, and make the extensions.

For complete information concerning these items, see Specifications and contract forms.

CONTRACT PROPOSAL

Holt Memorial Park Enhancements - 34 Elmont Avenue, Baltimore, Maryland 21206

CONTRACT NUMBER: 25054 GX0

WORKDAY NUMBER: 10001017

JOB ORDER NUMBER N/A

CALENDAR DAYS: 300

CONTRACTOR: _____
ADDRESS: _____
PHONE: _____

BID ITEM	COMM. CODE		DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL AMOUNT
1	0	0000	HOLT MEMORIAL PARK ENHANCEMENTS	1	LS		\$
TOTAL COST FOR CONTRACT							\$

TOTAL COST FOR CONTRACT IN WORDS

OFFICER SIGNATURE

TITLE

PROPOSAL AFFIDAVIT

1. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____ and the duly authorized representative of [business]_____ (the "Business") and that I possess the legal authority to make this Affidavit on behalf of myself and the Business for which I am acting.

2. PROPOSAL CERTIFICATION

THE UNDERSIGNED HEREBY ACKNOWLEDGES receipt of the following Addenda (list by number and date):

Accompanying this Proposal is a Bid Bond in an amount of 5% of the bid, the exact amount to be determined by the difference between the low bid and the next lowest bid, if two or more bids are received, or 5% of the bid if one bid is received. This guarantees payment to Baltimore County of the amount thus determined as liquidated damages in case of default in any matter specified as required before award or in any matter resulting in failure to execute and deliver an Agreement, together with Payment and Performance Bonds, after award.

3. AFFIRMATION REGARDING BRIBERY CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies (as is defined in Section 16-101(f) of the State Finance and Procurement Article of the Annotated Code of Maryland), has been convicted of, or has had probation before judgment imposed pursuant to Section 6-225 of the Criminal Procedure Article of the Annotated Code of Maryland, or has pleaded nolo contendere to a charge of, bribery, attempted bribery, or conspiracy to bribe in violation of Maryland law, or of the law of any other state or federal law, except as follows [indicate the reasons why the affirmation cannot be given and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of person(s) involved, and their current positions and responsibilities with the Business]:

4. AFFIRMATION REGARDING OTHER CONVICTIONS

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies, has:

(1) Been convicted under state or federal statute of a criminal offense incident to obtaining, attempting to obtain, or performing a public or private contract, fraud, embezzlement, theft, forgery, falsification or destruction of records, or receiving stolen property;

(2) Been convicted of any criminal violation of a state or federal antitrust statute;

(3) Been convicted under the provisions of Title 18 of the United States Code for violation of the Racketeer Influenced and Corrupt Organization Act, 18 U.S.C. §1961, et seq., or the Mail Fraud Act, 18 U.S.C. §1341, et seq., for acts arising out of the submission of bids or proposals for a public or private contract;

(4) Been convicted of a violation of the State Minority Business Enterprise Law, Section 14-308 of the State Finance and Procurement Article of the Annotated Code of Maryland;

(5) Been convicted of conspiracy to commit any act or omission that would constitute grounds for conviction or liability under any law or statute described in subsection (1), (2), (3), or (4) above;

(6) Been found civilly liable under a state or federal antitrust statute for acts or omissions in connection with the submission of bids or proposals for a public or private contract;

(7) Admitted in writing or under oath, during the course of an official investigation or other proceedings, acts or omissions that would constitute grounds for conviction or liability under any law or statute described above, except as follows [indicate reasons why the affirmations cannot be given, and list any conviction, plea, or imposition of probation before judgment with the date, court, official or administrative body, the sentence or disposition, the name(s) of the person(s) involved and their current positions and responsibilities with the Business, and the status of any debarment]:

5. AFFIRMATION REGARDING DEBARMENT

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, partners, or any of its employees directly involved in obtaining or performing contracts with public bodies, has ever been suspended or debarred (including being issued a limited denial of participation) by any public entity, except as follows [list each debarment or suspension providing the dates of the suspension or debarment, the name of the public entity and the status of the proceeding, the name(s) of the person(s) involved and their current positions and responsibilities with the Business, the grounds of the debarment or suspension, and the details of each person's involvement in any activity that formed the grounds of the debarment or suspension]:

6. AFFIRMATION REGARDING DEBARMENT OF RELATED ENTITIES

I FURTHER AFFIRM THAT:

(1) The Business was not established and it does not operate in a manner designed to evade the application of or defeat the purpose of debarment pursuant to Sections 16-101, et seq., of the State Finance and Procurement Article of the Annotated Code of Maryland; and

(2) The Business is not a successor, assignee, subsidiary, or affiliate of a suspended or debarred business, except as follows: [you must indicate the reasons why the affirmations cannot be given without qualification]:

7. SUB-CONTRACT AFFIRMATION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, has knowingly entered into a contract with a public body under which a person debarred or suspended under Title 16 of the State Finance and Procurement Article of the Annotated Code of Maryland will provide, directly or indirectly, supplies, services, architectural services, construction related services, leases of real property, or construction.

8. AFFIRMATION REGARDING COLLUSION

I FURTHER AFFIRM THAT:

Neither I, nor to the best of my knowledge, information, and belief, the Business, nor any of its officers, directors, members or partners, nor any of its employees, have in any way:

(1) Agreed, conspired, connived, or colluded to produce a deceptive show of competition in the compilation of the accompanying bid or offer that is being submitted;

(2) In any manner, directly or indirectly, entered into any agreement of any kind to fix the bid price or price proposal of the bidder or offeror or of any competitor, or otherwise take any action in restraint of free competitive bidding in connection with the contract for which the accompanying bid or offer is submitted;

(3) Colluded with anyone to obtain information concerning the bid that would give the Business an unfair advantage over others.

9. POLITICAL CONTRIBUTION DISCLOSURE AFFIRMATION

I FURTHER AFFIRM THAT:

The Business affirms that it is aware of, and will comply with, the provisions of Sections 14- 101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, which require that every person who makes, during any 12-month period, one or more contracts, with one or more Maryland governmental entities involving cumulative consideration, or at least \$200,000.00, shall file with the State Board of Elections certain specified information to include disclosure of attributable political contributions in excess of \$500 during defined reporting periods.

10. CERTIFICATION OF CORPORATION REGISTRATION AND TAX PAYMENT

I FURTHER AFFIRM THAT:

(1) The Business is a _____(State) (Corporation), (LLC), (Partnership), (Sole Proprietor/Individual), (Other:_____), that it **is** registered in accordance with the Corporations and Associations Article of the Annotated Code of Maryland, that it **is** in good standing in the State of Maryland, and that it **has** filed all of its annual reports, together with filing fees, with the Maryland State Department of Assessments and Taxation, and that the name and address of its resident agent filed with the State Department of Assessments and Taxation is:

Name: _____

Address: _____

(If none, so state)

(2) Except as validly contested, the Business has paid, or has arranged for payment of, all taxes due the State of Maryland and Baltimore County, and has filed all required returns and reports with the Comptroller of the Treasury, the State Department of Assessments and Taxation, and the Employment Security Administration, as applicable, and will have paid all withholding taxes due the State of Maryland prior to final settlement.

11. CONTINGENT FEES

I FURTHER AFFIRM THAT:

The Business has not employed or retained any person, partnership, corporation, or other entity, other than a bona fide employee or agent working for the Business, to solicit or secure the Contract, and that the Business has not paid or agreed to pay any person, partnership, corporation, or other entity, other than a bona fide employee or agent, any fee or other consideration contingent on the making of the Contract.

12. NONDISCRIMINATION IN EMPLOYMENT STATEMENT

I FURTHER AFFIRM THAT:

During the performance of any contract awarded of which this affidavit is a part:

(1) The Business will not discriminate against any employee or applicant for employment because of race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test. The Business will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test. Such action shall include, but not be limited to the following: employment, promotion, upgrading, demotion or transfer, rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Business agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the owner setting forth provisions of this nondiscrimination clause.

(2) The Business will, in all solicitations or advertisements for employees placed by or on behalf of the Business, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, age, national origin, marital status, sexual orientation, genetic information, or disability unrelated in nature and extent so as to reasonably preclude the performance of the employment, or because of the individual's refusal to submit to a genetic test or make available the results of a genetic test.

(3) The Business shall send to each labor union or representative of workers with which the Business has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the owner, advising the said labor union or workers' representative of these commitments, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Business shall furnish, if requested by the County, a compliance report concerning our employment practices and policies in order for the County to ascertain compliance with the special provisions of this affidavit concerning nondiscrimination in employment.

(5) In the event of the Business's noncompliance with the nondiscrimination clause of this affidavit, the contract may be canceled, terminated, or suspended in whole or in part, and the Business may be declared ineligible for further County work.

(6) The Business shall include the special provisions outlined herein pertaining to nondiscrimination in employment in every subcontract, so that such nondiscrimination in employment provisions shall be binding on each subcontractor or vendor.

13. FOREIGN CONTRACTS

I FURTHER AFFIRM THAT:

The Business affirms that it is aware of, and will comply with, the provisions of Sections 10-2-110 Article 10. Finance, Title 2 – Purchasing, Baltimore County Code 2003, which requires that prior to the award of a contract for services under the provisions of this title, and during the entire term of a contract award, the bidder or vendor shall disclose to the County whether any services covered by the bid or contract, including any subcontracted services, will be performed outside the United States. The disclosure shall be made to the Office of Budget and Finance, Purchasing Bureau.

14. MINORITY BUSINESS ENTERPRISE AND FEMALE CONTRACTORS

THIS BUSINESS INTENDS to affirmatively seek out and consider minority business enterprises to participate in this contract as subcontractors and/or suppliers of materials and services.

THE UNDERSIGNED UNDERSTANDS AND AGREES: that any and all subcontracting of supplies and services in connection with this contract, whether undertaken before or after award of contract, will be in accordance with the Minority Business Enterprise and Female Contractor requirement included in the Bid Proposal package and incorporated herein as if fully set forth; and

THE UNDERSIGNED ALSO UNDERSTANDS AND AGREES that no subcontracting will be approved until Baltimore County has reviewed and approved the affirmative actions taken by this firm.

15. REQUIREMENTS FOR EXECUTING AFFIDAVIT & PROPOSAL

The Affidavit must be signed in ink in order for the bid to be accepted and that the Proposal must be typewritten or filled out in ink.

THE UNDERSIGNED ALSO UNDERSTANDS that:

Proposals submitted by an INDIVIDUAL must be signed by an individual.

Proposals submitted by a PARTNERSHIP must be signed by the partner who is legally authorized authority to bind the partnership. Attach a copy of the Partnership Agreement and a duly certified resolution evidencing the authority of the partner so signing on behalf of the partnership.

Proposals submitted by a CORPORATION must be signed by a legally authorized officer of the corporation and attested to by the Corporate Secretary. Attach a copy of the Articles of Incorporation, By-Laws and a duly certified Board Resolution evidencing the authority of the officer so signing on behalf of the corporation.

Proposals submitted by a LIMITED LIABILITY COMPANY must be signed by a legally authorized member of the company and attested to. Attach a copy of the Operating Agreement, Articles of Organization and a duly certified resolution evidencing the authority of the member so signing on behalf of the limited liability company.

NOTE: The contractor may file with the County a list of the names of those officers, partners or members, as applicable, having legal authority to execute documents on behalf of and legally bind the contractor, duly certified, as applicable and legally required, together with the aforesaid corporate documents, which shall remain in full force and effect until such time as the County Department of Public Works and Transportation, Construction Contract Administration is advised in writing to the contrary.

16. ACKNOWLEDGMENT

I ACKNOWLEDGE THAT this Affidavit is to be furnished to the County and may be distributed to units of (1) Baltimore County; (2) the State of Maryland; (3) other counties or political subdivisions of the State of Maryland; (4) other states; and (5) the federal government. I further acknowledge that this Affidavit is subject to applicable laws of the United States and the State of Maryland, both criminal and civil, and that nothing in this Affidavit or any contract resulting from the submission of this bid or proposal shall be construed to supersede, amend, modify or waive, on behalf of Baltimore County, or the State of Maryland or any unit of the State of Maryland having jurisdiction, the exercise of any statutory right or remedy conferred by the Constitution and the laws of Maryland with respect to any misrepresentation made or any violation of the obligations, terms and covenants undertaken by the Business with respect to (a) this Affidavit, (b) the contract, and (3) other Affidavits comprising part of the contract.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

WITNESS/ATTEST:

_____	By: _____
Date: _____	Name: _____
	Title: _____
	(Authorized Representative and Affiant)

BID BOND

Principal

Business Address of Principal

Surety

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

Five Percent of Bid Amount \$ _____ 5% of Bid

Penal Sum of Bond [shall be determined pursuant to latest revised Specification / G.P. 2.07 (2000 Ed.)]

Holt Memorial Park Enhancements
Contract Name

25054 GX0
Contract Number/Proposal Item Number

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal, above named, and Surety, above named, and authorized to do business in the State of Maryland, are held and firmly bound unto the Oblige, above named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that if the aforesaid Principal is the apparent low bidder and complies with all specified matters required before award or if the aforesaid Principal is awarded the contract, the said Principal will, within the time required, execute and deliver to the Oblige a formal contract and good and sufficient payment and performance bonds in the form provided by the Oblige, then, this obligation to be void; otherwise the Principal and Surety will, upon demand, pay unto the Oblige the entire Penal Sum of this Bid Bond as liquidated damages.

THE SURETY FURTHER GUARANTEES No Proposal will be considered unless accompanied by a guaranty of the amount specified in the Proposal in the form of either a certified check, bank cashier's check or a Bid Bond on the form provided therein or an exact facsimile thereof. The Bid Bond must be executed by a Surety that is, as of the date of the Bid: (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. The Bid Bond must guaranty payment to the County of liquidated damages as follows: (a) if only one Bid is received, the guaranteed payment shall be five (5%) percent of the Bidder's Bid amount, (b) if two or more Bids are received, the guaranteed payment shall be the difference between the Bidder's Bid amount and the next lowest Bid amount, subject to the limitation that the guaranteed payment not be greater than five (5%) percent of the Bidder's Bid amount. This Bid Bond is required in case the successful Bidder, after issuance of notice of Award, fails to comply, timely and completely, with each of the requirements set forth under Section GP-3.04.

Signed and sealed _____
Date

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:

Individual Principal

Witness: _____

as to: _____ (SEAL)

Print Name: _____

Print Name: _____

Corporate Principal

In Presence of:

(Name of Corporation)

Witness: _____

By: _____

Print Name: _____

Print Name: _____ (SEAL)

Title: _____

Surety

(Name of Surety)

Business Address: _____

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal



First Source Hiring Agreement Overview

What is First Source Hiring?

Baltimore County's First Source Hiring Agreement requires that developers, contractors, and employers utilize good faith efforts toward employing economically disadvantaged Baltimore County residents in newly created positions on applicable projects. These efforts are supported by Baltimore County's workforce development system, a partnered network of business and economic development professionals, education and training providers, and human service agencies working together systematically to provide a ready supply of qualified workers to employers with hiring needs. The intent of First Source is to connect these individuals with new jobs that are generated by the County's investment in contracts or public works; or by business activity that requires approval by the County's Department of Economic and Workforce Development.

The goals of the First Source Hiring Agreement are to:

- Increase awareness of the resources, services and potential benefits available to help Baltimore County employers meet their workforce needs; and,
- Give economically disadvantaged individuals the first opportunity to apply for new jobs in Baltimore County.

Which businesses can participate in First Source Hiring?

1. Businesses who have leases with the County or on County property; or,
2. Businesses with County contracts for goods, services, and grants under \$300,000 which are projected to create new jobs/positions to fulfill contract terms

How can first source help your business?

Baltimore County Department of Economic & Workforce Development's (DEWD's) Business Services Team can help coordinate recruitment services with our workforce partners in collaboration with our three Baltimore County Career Center locations to assist with finding pre-screened, qualified candidates.

Available services may include but are not limited to:

- Posting and promotion of employment opportunities through our network of service providers
- Access to diverse talent pools from within Baltimore County's workforce system
- Access to Baltimore County Career Centers for coordinated recruitment/interviewing activities
- Referral of pre-screened, qualified candidates for employer consideration
- Assistance with using the Maryland Workforce Exchange - a statewide job database and candidate matching platform
- Information on earning tax credits and other employer benefits for new hires (if applicable)
- Workforce and Business Services staff to assist you throughout your recruitment efforts

I'd like to participate in First Source Hiring...Where do I start?

Step #1: Register your business with the [Maryland Workforce Exchange](#). This is an online database to track First Source Hiring job opportunities. As an employer, the Maryland Workforce Exchange can help you promote job openings, search for qualified candidates and share placement information.

Step #2: Businesses or non-profits who receive a non-construction or professional services contract from Baltimore County under \$300,000 are required to project the number of job openings they expect during the contract period. After registering your business with [Maryland Workforce Exchange](#), complete the **First Source Hiring Description Form** and email it to the Baltimore County Department of Economic and Workforce Development (DEWD) at firstsourcehire@baltimorecountymd.gov . If you have any questions about registering with MWE or completing the form, contact our office at 410-887-8000.

Step #3: Once you are registered in MWE and Baltimore County receives your **First Source Hiring Description Form** via email, you will be contacted by a member of the Business Development Team to assist with recruitment for your open positions.

Helpful Tips:

Businesses that qualify are asked to post their openings with Baltimore County's First Source Hiring network of service providers, and offer the County the first opportunity to refer qualified candidates to those positions. While the agreement does not require an employer to hire a specific candidate, it does ask that employers make a good faith effort to hire referrals from the County's workforce development system. We ask that employers would report basic information for any new hires by entering the placement data in the Maryland Workforce Exchange, or by completing an Employment Verification and Employer Survey Form (see FORM 2 attached) or via email at the completion of your recruitment activities.

Company Name

Contact Name

Company Address

City, MD

E-mail Address

Telephone

Acknowledgment Signature

Date

STATE OF MARYLAND
DEPARTMENT OF LABOR
DIVISION OF LABOR AND INDUSTRY
PREVAILING WAGE SECTION
10946 Golden West Drive, Suite 160
Hunt Valley, MD 21031
(410) 767-2342

11/19/2025

REQUEST FOR ADVERTISEMENT AND NOTICE TO PROCEED

Heather Panowicz - Procurement Officer
Dept of Public Works and Transportation
111 West Chesapeake Ave Room 300B
Towson, MD 21204

Re: Holt Park Enhancements
Project No: 25054 GX0

Enclosed please find the Prevailing Wage Determination and Instructions for Contractors for the project referenced above.

Upon advertisement for bid or proposal of this project, you are requested to submit to this office the date and name of publication in which such advertisement appeared.

Once awarded, you are further directed to submit to this office, the NOTICE TO PROCEED for the project, complete with the date of notice, the name of the general contractor, and the dollar amount of the project. In addition, we ask that a representative of the prevailing wage Unit be invited to attend the Pre-Construction Conference.

Any questions concerning this matter may be referred to PrevailingWage@dllr.state.md.us

Sincerely,

Enclosures
Wage Determination
Instruction for the Contractor

Prevailing Wage Unit

PREVAILING WAGE INSTRUCTIONS FOR THE CONTRACTOR & SUBCONTRACTOR

The contractor shall electronically submit completed copies of certified payroll records to the Commissioner of Labor & Industry, Prevailing Wage Unit by going on-line to <https://www.dllr.state.md.us/prevwage> and following the instructions for submitting payroll information (NOTE: A contractor must register prior to submitting on-line certified payroll information).

If you have technical questions regarding electronic submittal, contact the Department at dldlprevailingwage-dllr@maryland.gov.

All certified payroll records shall have an accurate week beginning and ending date. The contractor shall be responsible for certifying and submitting to the Commissioner of Labor and Industry, Prevailing Wage Unit all of their subcontractors' payroll records covering work performed directly at the work site. By certifying the payroll records, the contractor is attesting to the fact that the wage rates contained in the payroll records are not less than those established by the Commissioner as set forth in the contract, the classification set forth for each worker or apprentice conforms with the work performed, and the contractor or subcontractor has complied with the provisions of the law.

A contractor or subcontractor may make deductions that are (1) required by law; (2) required by a collective bargaining agreement between a bona fide labor organization and the contractor or subcontractor; or (3) contained in a written agreement between an employee and an employer undertaken at the beginning of employment, if the agreement is submitted by the employer to the public body awarding the public work and is approved by the public body as fair and reasonable.

A contractor or subcontractor is required to submit information on-line on their fringe benefit packages including a list of fringe benefits for each craft employed by the contractor or subcontractor, by benefit and hourly amount. Where fringe benefits are paid in cash to the employee or to an approved plan, fund, or program, the contribution is required to be indicated.

Payroll records must be electronically submitted and received within 14 calendar days after the end of each payroll period. If the contractor is delinquent in submitting payroll records, processing of partial payment estimates may be held in abeyance pending receipt of the records. In addition, if the contractor is delinquent in submitting the payroll records, the contractor shall be liable to the contracting public body for liquidated damages. The liquidated damages are \$10.00 for each calendar day the records are late.

Only apprentices registered with the Maryland Apprenticeship and Training Council shall be employed on prevailing wage projects. Apprentices shall be paid a percentage of the determined journey person's wage for the specific craft.

Overtime rates shall be paid by the contractor and any subcontractors under its contracts and agreements with their employees which in no event shall be less than time and one-half the prevailing hourly rate of wages for all hours worked in excess of ten (10) hours in any one calendar day; in excess of forty (40) hours per workweek; and work performed on Sundays and legal holidays.

Contractors and subcontractors employing a classification of worker for which a wage rate was not issued SHALL notify the Commissioner of Labor & Industry, Prevailing Wage Unit, for the purpose of obtaining the wage rate for said classification PRIOR TO BEING EMPLOYED on the project. To obtain a prevailing wage rate which was NOT listed on the Wage Determination, a contractor or subcontractor can look on the LABOR webpage under prevailing wage.

Contractors and subcontractors shall maintain a valid copy of proper State and county licenses that permit the contractor and a subcontractor to perform construction work in the State of Maryland. These licenses must be retained at the worksite and available for review upon request by the Commissioner of Labor and Industry's designee.

****Each contractor under a public work contract subject to Section 17-219 shall:**

1. Post a clearly legible statement of each prevailing wage rate to be paid under the public work contract; and
2. Keep the statement posted during the full time that any employee is employed on the public work contract.
3. The statement of prevailing wage rates shall be posted in a prominent and easily accessible place at the site of the public work.

****Penalty - Subject to Section 10-1001 of the State Government Article, the Commissioner may impose on a person that violates this section a civil penalty of up to \$50.00 per violation.**

Under the Maryland Apprenticeship and Training Council requirements, consistent with proper supervision, training and continuity of employment and applicable provisions in collective bargaining agreements, a ratio of one journey person regularly employed to one apprentice shall be allowed. No deviation from this ratio shall be permitted without prior written approval from the Maryland Apprenticeship and Training Council.

Laborers may NOT assist mechanics in the performance of the mechanic's work, NOR USE TOOLS peculiar to established trades.

ALL contractors and subcontractors shall employ only competent workers and apprentices and may NOT employ any individual classified as a HELPER or TRAINEE on a prevailing wage project.

The State Apprenticeship and Training Fund (Fund) law provides that contractors and certain subcontractors performing work on certain public work contracts are required to make contributions toward apprenticeship. See §17-601 through 17-606, State Finance and Procurement, Annotated Code of Maryland. Contractors and subcontractors have three options where they can choose to make their contributions: (1) participate in a registered apprenticeship training program; (2) contribute to an organization that has a registered apprenticeship training program; or (3) contribute to the State Apprenticeship and Training Fund.

The Department of Labor (LABOR) is moving forward with final adoption of regulations. The regulations were published in the December 14, 2012 edition of the Maryland Register.

IMPORTANT: Please note that the obligations under this law will become effective on JULY 1, 2013. This law will require that contractors and certain subcontractors make contributions toward apprenticeship and report those contributions on their certified payroll records that they submit pursuant to the prevailing wage law.

The Department is offering outreach seminars to any interested parties including contractors, trade associations, and any other stakeholders. Please contact the Department at dldlprevailingwage-dllr@maryland.gov or (410) 767-2968 for seminar times and locations. In addition, information regarding this law will be provided at pre-construction meetings for projects covered by the Prevailing Wage law.

**For additional information, contact:
Division of Labor and Industry
Maryland Apprenticeship and Training
1100 North Eutaw Street, Room 606
Baltimore, Maryland 21201
(410) 767-2246
E-Mail Address: matp@dllr.state.md.us.**

STATE OF MARYLAND
DEPARTMENT OF LABOR
DIVISION OF LABOR AND INDUSTRY
PREVAILING WAGE SECTION
1100 N. Eutaw Street, Room 607
Baltimore, MD 21201
(410) 767-2342

The wage rates to be paid laborers and mechanics for the locality described below is announced by order of Commissioner of Labor and Industry.

It is mandatory upon the successful bidder and any subcontractor under him, to pay not less than the specific rates to all workers employed by them in executing contracts in this locality. Reference: Annotated Code of Maryland State Finance and Procurement, Section 17-201 thru 17-226.

These wage rates were taken from the locality survey of 2024 for Baltimore County, issued pursuant to the Commissioner's authority under State Finance and Procurement Article Section 17-209, Annotated Code of Maryland or subsequent modification.

****Note:** If additional Prevailing Wage Rates are needed for this project beyond those listed below, contact the Prevailing Wage Unit. Phone: (410) 767-2342, email: prevailingwage@dllr.state.md.us.

Name and Title of Requesting Officer: Heather Panowicz - Procurement Officer
Department, Agency or Bureau: Dept of Public Works and Transportation
111 West Chesapeake Ave Room 300B Towson, MD 21204

Project Number
25054 GX0

Location and Description of work:

Determination Number
64168

Baltimore County: Renovations to four onsite structures, to include door removal/installation, water heater replacement, floor renovation, and new ADA bathrooms. Exterior renovations to include railings/porch, ADA entrances, and roof replacement.

Date of Issue: Nov 19, 2025

BUILDING CONSTRUCTION

CLASSIFICATION	MODIFICATION REASON	BASIC HOURLY RATE	BORROWED FROM	FRINGE BENEFIT PAYMENT
BALANCING TECHNICIAN	CR	\$47.92		\$24.44
BRICKLAYER	CR	\$37.50		\$14.78
CARPENTER	CR	\$34.41		\$14.49
CARPENTER - SHORING SCAFFOLD BUILDER	CR	\$34.41		\$14.49
CARPET LAYER	CR	\$34.12		\$14.86
CEMENT MASON	SR	\$25.00	005	\$1.94
COMMUNICATION INSTALLER TECHNICIAN	SR	\$36.37	005	\$12.89
DRYWALL - SPACKLING, TAPING, & FINISHING	CR	\$34.41		\$14.49
ELECTRICIAN	CR	\$47.13		\$21.94
ELEVATOR MECHANIC	CR	\$56.36		\$45.50
FIREPROOFER - SPRAYER	CR	\$32.50		\$11.37

FIRESTOPPER	CR	\$29.81		\$10.08
GLAZIER	CR	\$35.60		\$14.41
INSULATION WORKER	CR	\$40.02		\$19.92
IRONWORKER - FENCE ERECTOR	CR	\$40.02		\$19.92
IRONWORKER - ORNAMENTAL	CR	\$31.17	510	\$24.38
IRONWORKER - REINFORCING	CR	\$29.20	510	\$23.57
IRONWORKER - STRUCTURAL	CR	\$33.12		\$25.63
MILLWRIGHT	CR	\$38.61		\$17.21
PAINTER	CR	\$28.55		\$11.87
PAINTER-INDUSTRIAL	CR	\$35.55		\$15.28
PILEDRIVER	SR	\$36.60	005	\$16.78
PLUMBER	CR	\$46.21		\$24.90
POWER EQUIPMENT OPERATOR - ASPHALT DISTRIBUTOR	CR	\$31.72		\$13.02
POWER EQUIPMENT OPERATOR - BACKHOE	CR	\$33.00	510	\$13.55
POWER EQUIPMENT OPERATOR - BROOM / SWEEPER	CR	\$32.23	510	\$14.62
POWER EQUIPMENT OPERATOR - BULLDOZER	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - CONCRETE PUMP	CR	\$44.35		\$0.00
POWER EQUIPMENT OPERATOR - CRANE	CR	\$41.00		\$18.10
POWER EQUIPMENT OPERATOR - CRANE - TOWER	CR	\$41.00		\$18.10
POWER EQUIPMENT OPERATOR - DRILL - RIG	CR	\$33.16		\$14.15
POWER EQUIPMENT OPERATOR - EXCAVATOR	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - FORKLIFT	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - GRADALL	CR	\$34.00	510	\$13.55
POWER EQUIPMENT OPERATOR - GRADER	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - GUARD RAIL POST DRIVER	CR	\$23.50		\$5.07
POWER EQUIPMENT OPERATOR - LOADER	CR	\$34.18		\$14.62
POWER EQUIPMENT OPERATOR - MECHANIC	CR	\$36.24		\$14.62
POWER EQUIPMENT OPERATOR - MILLING MACHINE	CR	\$30.58	510	\$13.55
POWER EQUIPMENT OPERATOR - PAVER	CR	\$32.10	510	\$13.55
POWER EQUIPMENT OPERATOR - ROLLER - ASPHALT	CR	\$32.10	510	\$13.55
POWER EQUIPMENT OPERATOR - ROLLER - EARTH	CR	\$28.60		\$14.62
POWER EQUIPMENT OPERATOR - SCREED	CR	\$30.00	510	\$11.80
POWER EQUIPMENT OPERATOR - SKID STEER (BOBCAT)	CR	\$32.23		\$14.62
POWER EQUIPMENT OPERATOR-VACUUM TRUCK	CR	\$37.50		\$14.85
RESILIENT FLOOR	CR	\$34.12		\$14.86
ROOFER/WATERPROOFER	SR	\$52.21	009	\$14.91
SHEETMETAL WORKER (INCLUDING METAL ROOFING)	CR	\$47.92		\$24.44
SPRINKLERFITTER	CR	\$42.32	510	\$26.05
STEAMFITTER/PIPEFITTER	CR	\$46.21		\$24.90
STONE MASON	CR	\$44.30	510	\$21.22
TILE & TERRAZZO FINISHER	CR	\$28.09		\$12.59
TILE & TERRAZZO MECHANIC	CR	\$33.41		\$14.24
TRUCK DRIVER - DUMP	CR	\$17.64	510	\$1.92
TRUCK DRIVER - FLATBED	CR	\$20.94		\$7.63
TRUCK DRIVER - LOWBOY	CR	\$29.68	510	\$10.51
TRUCK DRIVER - TACK/TAR TRUCK	CR	\$27.35	510	\$8.97

TRUCK DRIVER - WATER	CR	\$27.49	\$8.11
LABORER GROUP II			
LABORER - ASPHALT RAKER	AD	\$22.63	\$4.88
LABORER - COMMON	AD	\$22.63	\$4.88
LABORER - CONCRETE PUDDLER	AD	\$22.63	\$4.88
LABORER - CONCRETE TENDER	AD	\$22.63	\$4.88
LABORER - CONCRETE VIBRATOR	AD	\$22.63	\$4.88
LABORER - DENSITY GAUGE	AD	\$22.63	\$4.88
LABORER - FIREPROOFER - MIXER	AD	\$22.63	\$4.88
LABORER - FLAGGER	AD	\$22.63	\$4.88
LABORER - GRADE CHECKER	AD	\$22.63	\$4.88
LABORER - HAND ROLLER	AD	\$22.63	\$4.88
LABORER - JACKHAMMER	AD	\$22.63	\$4.88
LABORER - LANDSCAPING	AD	\$22.63	\$4.88
LABORER - LAYOUT	AD	\$22.63	\$4.88
LABORER - LUTEMAN	AD	\$22.63	\$4.88
LABORER - MORTAR MIXER	AD	\$22.63	\$4.88
LABORER - PLASTERER - HANDLER	AD	\$22.63	\$4.88
LABORER - TAMPER	AD	\$22.63	\$4.88
LABORERS GROUP I			
LABORER - AIR TOOL OPERATOR	AD	\$24.46	\$9.69
LABORER - ASPHALT PAVER	AD	\$24.46	\$9.69
LABORER - BLASTER - DYNAMITE	AD	\$24.46	\$9.69
LABORER - BURNER	AD	\$24.46	\$9.69
LABORER - CONCRETE SURFACER	AD	\$24.46	\$9.69
LABORER - HAZARDOUS MATERIAL HANDLER	AD	\$24.46	\$9.69
LABORER - MASON TENDER	AD	\$24.46	\$9.69
LABORER - PIPELAYER	AD	\$24.46	\$9.69
LABORER - SCAFFOLD BUILDER	AD	\$24.46	\$9.69

Incidental Craft Data: Caulker, Man Lift Operator, Rigger, Scaffold Builder, and Welder receive the wage and fringe rates prescribed for the craft performing the operation to which welding, scaffold building, rigging, operating a Man Lift, or caulking is incidental.

These **Informational Prevailing Wage Rates** may not be substituted for the requirements of pre-advertisement or onsite job posting for a public work contract that exceeds \$250,000 in value and either of the following criteria are met: (1) the contracting body is a unit of State government or an instrumentality of the State and there is any State funding for the project; or (2) the contracting body is a political subdivision, agency, person or entity (such as a county) and the State funds 25% or more of the project.

Modification Codes:

- (AD) 17-209 Annual Determination from Survey Wage Data Received
- (CH) 17-211 Commissioners' Hearing
- (CR) 17-208 Commissioners' Review
- (SR) 17-208 Survey Review by Staff

Each "Borrowed From" county is identified with the FIPS 3-digit county code unique for the specific jurisdiction in Maryland.

For additional information on the FIPS (Federal Information Processing Standard) code, see <http://www.census.gov/datamap/fipslist/AllSt.txt>

The Prevailing Wage rates appearing on this form were originally derived from Maryland's annual Wage Survey. The Commissioner of Labor & Industry encourages all contractors and interested groups to participate in the voluntary Wage Survey, detailing wage rates paid to workers on various types of construction throughout Maryland.

A mail list of both street and email addresses is maintained by the Prevailing Wage Unit to enable up-to-date prevailing wage information, including Wage Survey notices to be sent to contractors and other interested parties. If you would like to be included in the mailing list, please forward (1) your Name, (2) the name of your company (if applicable), (3) your complete postal mailing address, (4) your email address and (5) your telephone number to PWMAILINGLIST@dllr.state.md.us. Requests for inclusion can also be mailed to: Prevailing Wage, 1100 N. Eutaw Street - Room 607, Baltimore MD 21201-2201.

BALTIMORE COUNTY, MARYLAND
USE OF MINORITY BUSINESS ENTERPRISES AND WOMEN'S BUSINESS ENTERPRISES
IN
COUNTY CONTRACTS
MWBE Plan Package



Division of Diversity, Equity and Inclusion
The Jefferson Building
105 West Chesapeake Avenue
Towson, Maryland 21204
410-887-3407

www.baltimorecountymd.gov/go/mwbe



PROSPECTIVE BIDDERS/OFFERORS

Baltimore County Executive Order 2022-005 Use of Minority Business Enterprises and Women's Business Enterprises states:

SECTION 6. BID REQUIREMENTS.

- (A)(1) *All bidders shall submit a list of all subcontractors contacted in preparation of their bid package or proposal.*
(2) *The list shall include the service to be performed, bid amount, and the race/ethnicity/gender of the business owner(s).*
(B)(1) *All bidders shall submit a list of all subcontractors to be used on a county contract in the bid package.*
(2) *This list shall include all subcontractors (both MWBE and non-MWBE) used, the service to be performed, the total amount to be paid, and the race/ethnicity/gender of the owner.*

If the solicitation includes a MWBE **subcontracting** goal, you **MUST** demonstrate “**Good Faith**” **effort** either by:

1. Complete and sign FORM A, FORM B (to include FORM B-Prime if MWBE Prime wishes to count towards the goal) and FORM C **listing all subcontractors** with the initial bid submission.
 - a. *All Forms must be completed and signed. However, FORM C **MUST** be completed and signed by both the prime and the MWBE subcontractor.*
- OR**
2. If you are unable to meet any portion of the goal, you **MUST** do one of the following:
 - a. If you are requesting a **partial waiver**, complete and sign FORM A with initial bid submission. FORM B (to include FORM B-Prime if MWBE Prime wishes to count towards the goal) and FORM C (**listing all subcontractors**). In addition, complete, sign and submit FORM D and FORM E **accompanied with all supporting documentation** for the portion of the goal that will not be achieved as specified on FORM A.
 - b. If you are requesting a **full waiver**, complete and sign FORM A indicating your intent to request a full waiver **accompanied with a completed and signed FORM C listing all subcontractors**, FORM D and FORM E **accompanied with all supporting documentation. This MUST be submitted with the initial bid as specified on FORM A.**
 - c. *All Forms must be completed and signed. FORM C and FORM D **MUST** be completed and properly signed by both the Prime AND the MWBE subcontractor(s).*

NOTE: The MWBE **subcontracting** goal applies to ALL prime/general contractors including certified and non-certified minority and women owned firms. **However, a Minority-owned or a Women-owned prime may self-perform up to 50% of MWBE subcontracting goal set in the solicitation. The MWBE primes that wish to count towards the goal must list themselves on all appropriate forms.**

12/2023

BALTIMORE COUNTY, MARYLAND

MWBE PARTICIPATION SUMMARY

Executive Order: Minority Business Enterprises and Women Business Enterprises (MWBE) shall have the maximum opportunity to participate in the performance of contracts financed in whole, or in certain circumstances, in part with County funds. Accordingly, on December 6, 2022, the County Executive adopted the EXECUTIVE ORDER No. 2022-005 addressing MWBE participation in County contracts. The December 6, 2022 Executive Order may be found on the Baltimore County website at www.baltimorecountymd.gov/go/mwbe.

Each Contract: The County shall establish a minimum MWBE participation amount for each contract, as applicable.

Bidder/Officer Responsibility: The bidder/officer shall ensure that MWBE participation occurs in accordance with the contract requirements and the County Executive's Executive Order. All bidder/officers shall ensure that MWBE have the maximum opportunity to compete for and perform County contracts, as applicable. Baltimore County, Maryland, and/or its bidder/officers and contractors shall not discriminate on the basis of race, color, national origin, disability or sex in the award and performance of any County contract.

Mobilization Payments: For subcontractors, project start-up costs can also be significant. A subcontractor that has limited resources and access to credit may find that start-up expenses inhibit its ability to bid County contracts. Under circumstances where mobilization payments are approved for the prime contractor, the subcontractor should be paid an amount equal to their participation percentage no later than five (5) business days before they are required to mobilize to perform the contracted work.

Mobilization costs represent pre-contract costs incurred by a contractor to prepare a job site before the actual commencement of the contract. These costs can include movement of personnel and equipment to the project site and for the establishment of the Contractor's offices, buildings, and other facilities necessary to begin work.

APPROVED MWBE LISTINGS

Published compilations of approved and certified MWBE, contractors, subcontractors, material suppliers, etc. include:

DIRECTORY OF MINORITY BUSINESS ENTERPRISE (MDOT):

<https://marylandmdbe.mdbecert.com>

MINORITY BUSINESS DIRECTORY OF THE CITY OF BALTIMORE:

<https://baltimorecity.diversitycompliance.com>

BIDDER/OFFEROR'S ACTIONS

Seeking Firms:

The bidder/officer will seek commitments by subcontract or otherwise from MWBE firms for supplies and/or services, any combined value of which equals or exceeds the required percentage of MWBE participation goal for the County contract. However a MWBE Prime that affirms its MWBE status on the Minority and/or Women Prime Participation Affidavit may count up to 50% of the goal.

Expenditures for Materials and Supplies:

A bidder/officer may count toward its MWBE contract requirements all expenditures for materials and supplies obtained from MWBE suppliers and manufacturers, provided that the MWBE firm is furnishing and installing the materials and is certified to perform these services. If the MWBE firm is only being used as a supplier, wholesaler and/or regular dealer or is not certified to install the supplies/materials, for purposes of achieving the MWBE participation goal, you may only count sixty percent (60%) of the value of the subcontract for these supplies/products (60% Rule). To apply the 60% Rule, first divide the amount of the subcontract for these supplies/products only (not installation) by the total Contract value. Then, multiply the result by sixty percent (60%) and insert the percentage in the Percent of Total Contract field of Form B Subcontractor Participation Schedule.

BALTIMORE COUNTY, MARYLAND **MWBE PARTICIPATION SUMMARY**

Information to be supplied: All bidder/offers shall submit the following information to the County at the time of bid submission:

1. The name of an employee designated as the bidder/offers's liaison to the County's Minority Business Enterprise Office.
2. The following forms shall be completed and submitted:
 - Certified MWBE Utilization and Fair Solicitation Affidavit (**Form A**); from among those names appearing in the Approved MWBE Listings (excepting Federal Highway Administration projects, which exclusively require DBE approved and certified by the Maryland Department of Transportation MBE Advisory Committee);
 - A Subcontractor Participation Schedule (**Form B**) completed by the prime contractor for each MWBE listed on the Form.
 - A MWBE Prime Participation Schedule (Form B-Prime) completed by a MWBE prime contractor if the firm wishes to self-perform up to 50% of the MBE/WBE goal.
 - A MWBE Disclosure and Participation Statement (**Form C**) completed and signed by the prime contractor and MWBE firm for each MWBE listed on the Form. Form C **must match** what is stated on Form B.
 - If applicable, MWBE Subcontractor Unavailable Certificate (**Form D**) completed and signed by the prime contractor and MWBE for each MWBE listed on the Form.
3. If applicable, MWBE Outreach Efforts - Compliance Statement (**Form E**) completed and signed by the Bidder/Offers. The prime shall submit a list of all subcontractors.
4. For DPW contracts, if the bidder/offers intends to fulfill the MWBE requirements by use of a joint venture, he/she must submit a Joint Venture Disclosure Affidavit (**Form D-EEO-006-A** and **B**) showing the extent of MWBE participation. If a bidder/offers intends to use a MWBE joint venture as a subcontractor to meet its MWBE requirements, the affidavit must be submitted through the bidder/offers by the proposed subcontractors and signed by all parties.
5. If the bidder/offers's proposed MWBE participation does not meet the MWBE contract requirements, information sufficient to demonstrate that the bidder/offers has made every effort to meet the requirements must be submitted. (See DETERMINATION OF BID RESPONSIVENESS hereafter)

RECORDS AND REPORTS

Returning Records: The bidder/offers must keep such records as are necessary to determine compliance with its MWBE utilization requirements:

1. The MWBE and non-minority contractors, type of work being performed, actual values of work and services.
2. Documentation of all correspondence, contacts, telephone calls, etc., to obtain MWBE services for the contract.
3. All prime contractors and MWBE sub-contractors are required to report monthly, by the 10th of each month, to the County through an online system called PRISM. If the contractor cannot submit his/her report on time, he/she will notify the County MWBE office and request additional time to submit the report. Failure of the contractor to report in a timely manner may result in a finding of noncompliance. The County in its sole discretion and/or upon written request may require additional reports regarding MWBE. In the event you are not able to enter your payments in PRISM, a spreadsheet is attached for your use. Please be sure to list the PO for each invoice/ payment reported and include in your submission any corresponding documentation (e.g. copies of invoices or cancelled checks).

Retaining Records: All MWBE records must be retained for 3 years following the expiration or any earlier termination of the contract and shall be available for inspection and photocopying by the County.

Investigation and Notification: Whenever the County believes the bidder/offers, contractor, or any subcontractor may not be operating in compliance with the MWBE requirements, the County may, in its sole discretion, conduct an investigation. If the County finds the bidder/offers, contractor, or any subcontractor is not in compliance with the MWBE requirements, the County may exercise any and all rights and remedies available to the County, under the contract, at law or equity, as deemed applicable and appropriate by the County in its sole discretion.

BALTIMORE COUNTY, MARYLAND **MWBE PARTICIPATION SUMMARY**

DETERMINATION OF BID RESPONSIVENESS

Request for Deviation: If the bidder/offeror is unable to procure from MWBE firms (by subcontract or otherwise), supplies and services, any combined value of which equals the required percentage of the total value of the contract, the bidder/ offeror may request, in writing, a deviation or waiver of the contract requirements. To obtain such a waiver, the bidder/ offeror must submit the following information at the time bids are due:

1. The request for waiver request shall include (1) a signed unavailability statement (Form D) executed by all MBEs and WBEs that the bidder/offeror solicited for participation and (2) Outreach Efforts/Compliance Statement (Form E) that demonstrates the bidder/offeror's good faith efforts to comply with the contract requirements, including copies of solicitation documentation to all potential subcontractors:
2. Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder/offeror contacted each MWBE; and
3. Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.

Bid Rejection: The failure of any bidder/offeror (including the apparent low bidder/offeror) to provide a responsive MWBE Plan as required by the solicitation may result in the bidder/offeror being deemed non-responsive and the County's rejection of the bid.

Liquidated Damages If the County issues a notice of intent to awards contract to the apparent low bidder/offeror who provided a responsive MWBE Plan, but, if after said notice and before execution of Contract Documents, it is determined by the County that the apparent low bidder/offeror has failed to comply with the MWBE Plan, such failure may result in the recommendation by the appropriate Procurement Official to annul the award and forfeit the bidder/offeror's Proposal Guaranty to the County, not as a penalty, but as liquidated damages, it being acknowledged that actual damages will be difficult if not impossible to accurately measure. In addition, the County may proceed as it determines to be in its best interest, including but not limited to, the Notice of Award may be made to the next lowest responsive and responsible bidder/offeror or the work may be re-advertised.

Contract Breach: If, after execution of a County contract, the contractor becomes aware it may or will fail to fulfill the applicable MWBE requirements and/or may or will deviate from the contractor's bid response/contract terms, the contractor shall promptly advise the County of this in writing. Thereafter, the County will determine what action or remedy is appropriate on a case-by-case basis, in the County's sole discretion.

Approval Required for Changes: Any and all changes to the MWBE subcontractors or the type or amount of work to be performed by such subcontractors during the contract term must be mutually agreeable to the County and the contractor and shall be documented via a contract amendment, executed by legally authorized representatives of the County and the contractor.

Cooperation in Reviews: The bidder/offeror will cooperate with the County in any reviews of the contractor's procedures and practices with respect to MBE or WBE firms, which the County may from time to time conduct in its sole discretion.

Other: If the documents used to determine the contractor's efforts, achievement of, and/or the status of an MWBE requirement or fulfillment thereof contain false, misleading or misrepresented information, the contractor may be declared in breach of the contract and the County may take any and all actions and/or remedies available to the County under the contract, at law, or in equity. If an MWBE is disqualified by any public entity, including but not limited to, Baltimore City, the State or MDOT, at any time after award or during the term of the contract, the County may, in its sole discretion, require the prime contractor to promptly submit for County approval, the contractor's plans for fulfilling the required MWBE participation under the contract, and/or request such detail and additional information as the County, in its discretion deems appropriate.



PRIME CONTRACTOR MINORITY AND WOMEN PARTICIPATION AFFIDAVIT

A. AUTHORIZED REPRESENTATIVE

I HEREBY AFFIRM THAT:

I am the [title]_____ and the duly authorized representative of
[business]_____
_____ (the "Business") and that I possess the legal authority to make this
Affidavit on behalf of myself and the Business for which I am acting.

B. AFFIRMATION REGARDING MINORITY AND WOMEN PARTICIPATION

I FURTHER AFFIRM THAT:

I am aware that, pursuant to the December 6, 2022 Executive Order of Baltimore County, Maryland, the following words have the meanings indicated.

(A) "Minority Business Enterprise" or "MBE" means a business enterprise that is owned, operated and controlled by one or more minority group members (African American, Hispanic American, Asian American, or Native American) who have at least 51% ownership and in which the minority group members have operational and managerial control, interest in capital and earnings commensurate with their percentage of ownership.

(B) "Women's Business Enterprise" or "WBE" means a business enterprise that is owned, operated and controlled by one or more women who have at least 51% ownership and in which the women have operational and managerial control, interest in capital and earnings commensurate with their percentage of ownership.

____ The Prime is a MBE ☐ or WBE ☐

☐ Maryland State Department of Transportation (MDOT) # _____

☐ City of Baltimore # _____

☐ Name Other Jurisdiction: _____ # _____

☐ The ownership of the Noncertified MWBE business consists of _____ % minorities and _____ % women (for a total of _____ %), each of which has operational and managerial control, interest in capital and earnings commensurate with their percent ownership.

_____ % African American _____ % Hispanic American _____ % Women
_____ % Asian American _____ % Native American _____ % Disadvantaged (DBE)

____ The MWBE prime anticipates meeting up to 50% of the stated participation goal with its own workforce.

MWBE primes percentage must be stated on the MWBE PRIME PARTICIPATION SCHEDULE (FORM B-PRIME) to count towards the goal.

____ The prime anticipates ☐ does not anticipate ☐ utilizing subcontractors for _____ % of the work of the contract requirements, of which it anticipates _____ % will be MBEs and _____ % will be WBEs.

I DO SOLEMNLY DECLARE AND AFFIRM UNDER THE PENALTIES OF PERJURY THAT THE CONTENTS OF THIS AFFIDAVIT ARE TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE, INFORMATION, AND BELIEF.

Date: _____

By: _____

(Authorized Representative and Affiant's Name and Title)

BALTIMORE COUNTY, MARYLAND
Certified MWBE Utilization and Fair Solicitation Affidavit
(FORM A)

**This document must be completed and submitted with Bid/Proposal to Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

* * * * *

I acknowledge the goal for solicitation #25054 GX0 is a minimum of 30%. This goal must be met by any combination of the MWBE subcontractors. However, for instances where the Prime is counting up to 50% of the goal, the remaining goal balance must be met by any combination of the MWBE subcontractors.

- The goal breakdown is as follows:
 - _____ % Minority/Women Prime
 - _____ % for certified MBE-owned businesses and/or
 - _____ % for certified WBE-owned businesses.

I have made a good-faith effort to achieve this MWBE solicitation requirement. If awarded the contract, I will comply with this MWBE contract requirement and will continue to use my best efforts to increase MWBE participation during the contract term.

PLEASE CHECK ONE BOX (EITHER 1, 2, OR 3)

- 1 ☐ Prime has met the MWBE contract requirements for this solicitation and contract. I submit the Subcontractor Participation Form B and Form C, along with this Affidavit, which details how the Prime will achieve the contract requirements. Submit a complete list of all additional subcontractors
- Or**
- 2 ☐ After having made a good-faith effort to achieve the MWBE requirements, the Prime can only achieve partial success. I submit the Subcontractor Participation Form B, Form C, Form D and Form E along with this Affidavit, which details how the Prime will partially achieve the contract requirements. Submit a complete list of all additional subcontractors

I request a partial waiver and will meet the following MWBE participation goals:

- Partial waiver of MWBE subcontract participation:
 - _____ % Minority/Women Prime
 - _____ % for certified MBE-owned businesses and/or
 - _____ % for certified WBE-owned businesses.

Or

- 3 ☐ After having made a good faith effort to achieve the MWBE requirements for this contract, the Prime is unable to achieve the requirements and/or sub requirements for this contract. I submit the MWBE Participation Form D and Form E, along with this Affidavit, which details the steps the Prime has taken in an attempt to achieve the contract requirements. Therefore, I request a full waiver.

IF YOU HAVE CHECKED BOX 2 OR 3, THE FOLLOWING IS APPLICABLE:

- 1) If a bidder is unable to comply with the goals established in a bid for a project, the bidder may submit a request for a waiver at the time of bid submission. However, occasions for granting waivers will be limited.

BALTIMORE COUNTY, MARYLAND
Certified MWBE Utilization and Fair Solicitation Affidavit
(FORM A)

- 2) The request for waiver shall include documentation that demonstrates the bidder's good faith efforts to comply with the goals, including:
- a. Signed unavailability statements from all MBEs and WBEs that the bidder solicited for participation; and
 - b. Copies of solicitation documentation to include the scope of services to be performed by the subcontractors accompanied with the following:
 - i. Emails, letters, facsimile transmittals and confirmations containing plans, specifications, and anticipated time schedule for portions of the work to be performed and meeting notes and agendas clearly identifying the certified MBE or WBE classification and dates that the bidder contacted each; and
 - ii. Telephone logs containing names, addresses, dates, telephone numbers, work to be performed, anticipated time schedule and classification of certified MBEs and WBEs contacted.
 - iii. Responses from MWBE firms contacted to fulfill the goal.

As I have checked Box 2 or 3 of this Affidavit, I understand I must submit the following supporting documentation with the bid:

- *Subcontractor Participation Schedule* (Form B)
- *MWBE Subcontractor Disclosure and Participation Statement* (Form C)
- *MWBE Subcontractors Unavailable Certificate* (Form D) (if applicable)
- *MWBE Outreach Efforts – Compliance Statement* (Form E) (if applicable)

I acknowledge that the MWBE subcontractors/suppliers listed on the *Subcontractor Participation Schedule* (Form B) will be used to accomplish the percentage of MWBE participation that the Prime shall achieve. A fully executed Form C must match Form B.

In the solicitation of subcontract quotations or offers, MWBE subcontractors were provided the same information and amount of time to respond, as were non-MWBE subcontractors.

The solicitation process was conducted in such a manner so as to not place MWBE subcontractors at a competitive disadvantage to non-MWBE subcontractors.

I solemnly affirm under the penalties of perjury that this Affidavit is true to the best of my knowledge, information, and belief.

Bidder/Offeror Name

Phone Number

Address

Affiant Signature

Address (continued)

Printed Name & Title

E-mail address

Date

BALTIMORE COUNTY, MARYLAND
SUBCONTRACTOR PARTICIPATION
SCHEDULE (FORM B)

**This document must be completed and submitted with Bid/Proposal to
Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Prime Name Bid/Proposal Name and Number 1. Subcontractor Name and Tax ID Telephone Number _____ Email Address _____ Select One: ☐ MBE ☐ WBE ☐ SBE ☐ N/A Provide if Applicable: ☐ MDOT ☐ Baltimore City # _____	Prime Address, Telephone Number and Email Project Location Base Bid \$ _____ Subcontractor Address Minority Status (If applicable): ☐ African American ☐ Asian American Pacific ☐ Asian American Sub-continent ☐ Supplier, Wholesaler and/or Regular Dealer - 60% Rule ☐ Female ☐ Native American ☐ Hispanic American
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount 2. Subcontractor Name and Tax ID Telephone Number _____ Email Address _____ Select One: MBE ☐ WBE ☐ SBE ☐ N/A ☐ Provide if Applicable: ☐ MDOT ☐ Baltimore City # _____	Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule) _____ % Subcontractor Address Minority Status (If applicable): ☐ African American ☐ Asian American Pacific ☐ Asian American Sub-continent ☐ Supplier, Wholesaler and/or Regular Dealer - 60% Rule ☐ Female ☐ Native American ☐ Hispanic American
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount 3. Subcontractor Name and Tax ID Telephone Number _____ Email Address _____ Select One: MBE ☐ WBE ☐ SBE ☐ N/A ☐ Provide if Applicable: ☐ MDOT ☐ Baltimore City # _____	Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule) _____ % Subcontractor Address Minority Status (If applicable): ☐ African American ☐ Asian American Pacific ☐ Asian American Sub-continent ☐ Supplier, Wholesaler and/or Regular Dealer - 60% Rule ☐ Female ☐ Native American ☐ Hispanic American
NAICS Code(s), Work to be Performed and Subcontract Dollar Amount Subcontractor Total Dollar Amount \$ _____	Percent of Total Contract (See instructions on Page 1 of the MWBE PARTICIPATION SUMMARY for 60% rule) _____ % Total Subcontractor Percent of Entire Contract _____ %
Form Prepared by: Name/Date: _____ Title: _____ Email: _____	Reviewed and Accepted by Baltimore County Minority Business Enterprise Office Name _____ Title _____ Date _____

MBE or WBE Prime Participation Total	_____ %	\$ _____	
MBE Subcontracting Participation Total	_____ %	\$ _____	
WBE Subcontracting Participation	_____ %	\$ _____	
Total MWBE Participation	_____ %	\$ _____	
Total SBE Participation	_____ %	\$ _____	

BALTIMORE COUNTY, MARYLAND

**MWBE PRIME PARTICIPATION SCHEDULE
(Form B-Prime)**

PLEASE COMPLETE AND SUBMIT THIS FORM TO ATTEST EACH SPECIFIC ITEM OF WORK THAT YOU AS THE MWBE PRIME FIRM WILL PERFORM USING ITS OWN WORKFORCE PERTAINING TO THE PERCENTAGE STATED ON THE SUBCONTRACTOR PARTICIPATION SCHEDULE (FORM B) FOR PURPOSES OF MEETING THE MWBE PARTICIPATION GOALS.

**This document must be completed and submitted with Bid/Proposal to Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

Provided that _____ (Prime Contractor's Name) with Certification Number _____ is awarded the County contract in conjunction with Solicitation No. _____, such MWBE Prime Contractor intends to count the distinct, clearly defined portion of the work of the contract that the MBE/WBE Prime Contractor performs with its own forces toward fulfilling **up to fifty-percent (50%) of the MWBE participation goal**, at least \$ _____ which equals to _____% of the Total Contract Amount for performing the following products/services for the Contract:

NAICS CODE	WORK ITEM, SPECIFICATION NUMBER, LINE ITEMS OR WORK CATEGORIES (IF APPLICABLE). FOR CONSTRUCTION PROJECTS, GENERAL CONDITIONS MUST BE LISTED SEPARATELY.	DESCRIPTION OF SPECIFIC PRODUCTS AND/OR SERVICES	VALUE OF THE WORK

MWBE PRIME CONTRACTOR

Signature of Representative: _____

Printed Name and Title: _____

Firm's Name: _____

Federal Identification Number: _____

Address: _____

Telephone: _____

Email Address: _____

Certified Yes ☐ No ☐

Certifying Jurisdiction _____

Date: _____

MWBE PRIME CONTRACTOR

Minority Status:

☐ African American

☐ Hispanic American

☐ Women

☐ Asian American

☐ Native American

Reviewed and Accepted by Baltimore County Minority Business Enterprise Office

Name _____

Title _____

Date _____

BALTIMORE COUNTY, MARYLAND
MWBE SUBCONTRACTOR DISCLOSURE AND PARTICIPATION STATEMENT
(FORM C)

**This document must be completed and submitted with Bid/Proposal to Baltimore County.*

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

**NOTE: ANY INCONSISTENCY BETWEEN THIS FORM AND FORM B MWBE PARTICIPATION MAY
RENDER A BID/PROPOSAL NON-RESPONSIVE AND THE COUNTY WILL NOT CONSIDER YOU FOR
CONTRACT AWARD.**

Contract Name, Bid/Proposal Number: _____

Prime Contractor Name: _____

Name of MWBE Subcontractor: _____

Subcontractor Contact Name, Title

Subcontractor Email Address

☐ MDOT ☐ Baltimore City

_____ Certification Number

☐ MBE ☐ WBE ☐ SBE ☐ N/A

1. NAICS Code(s), Work/Services to be performed by MWBE Subcontractor: _____

**Percent of Total Contract (See instructions on Page 1 of the MWBE
PARTICIPATION SUMMARY for 60% rule)**

2. Subcontract Amount: \$ _____ or _____ % of the County contract cost.

3. Bonds - Amount and type required of Subcontractor if any: _____

4. MWBE Anticipated Commencement Date: _____ Completion Date: _____
Mobilization Cost Amount \$ _____

5. This is a MBE-Owned Business Firm: Yes _____ No _____

6. This is a WBE-Owned Business Firm: Yes _____ No _____

NOTE: If the Prime is notified that it will be awarded the above referenced contract, the undersigned MWBE subcontractor and Prime must enter into a subcontract for the work/service indicated above upon the Prime's execution of a contract for the above referenced project with Baltimore County, and provide a copy of the fully executed MWBE SUBCONTRACTOR PARTICIPATION NOTICE OF INTENT TO AWARD (FORM C-Subcontractor) accompanied with the anticipated Work Breakdown Schedule (providing the subcontractor's mobilization timeframe) to mwbe@baltimorecountymd.gov within 10 calendar days of receipt by the Prime of FORM C- Subcontractor from the County. The undersigned subcontractor is an MDOT or Baltimore City certified MWBE firm. The terms and conditions stated above are consistent with our agreements.

Signature of MWBE Subcontractor: _____ Date: _____

Prime's Printed Name and Title: _____ Email: _____

The terms and conditions stated above are consistent with our agreements.

Signature of Prime: _____ Date: _____

Revised 12/2024

BALTIMORE COUNTY, MARYLAND
MWBE –UNAVAILABILITY CERTIFICATE
(FORM D)

If applicable, this document must be completed and submitted with Bid/Proposal to Baltimore County.

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

1. It is hereby certified that the firm of _____
(Name of Minority firm)

located at _____
(Number) (Street)

(City) (State) (Zip)

was offered an opportunity to bid on the _____ contract.

2. The _____ (MWBE Firm), is either unavailable for the work/service or unable to prepare a bid for this project for the following reason(s):

Signature of Subcontractor MWBE Representative

Title

Date

MDOT/Baltimore City Certification #

Email Address #

Telephone #

3. PRIME'S SIGNATURE AND CERTIFICATION

I certify under oath that I contacted the Certified MWBE and they advised me that they are unavailable, unable to perform the work/services for the above-contract or failed to respond to repeated requests for a price proposal for the above-contract.

Signature of Prime

Title

Date

Rev 12/2024

BALTIMORE COUNTY, MARYLAND
MWBE - OUTREACH EFFORTS - COMPLIANCE STATEMENT
(FORM E)

****This document must be completed and submitted with Bid/Proposal to Baltimore County.***

NOTE: If you do not complete and submit this form with your bid or offer to the County, the County may, in its sole discretion, deem your bid or offer NON-RESPONSIVE and accordingly the COUNTY WILL NOT CONSIDER YOU FOR CONTRACT AWARD.

In conjunction with the bid or offer submitted in response to Solicitation Number _____, I state the following:

1. Bidder/Offeror identified opportunities to subcontract in these specific work categories:

2. Attached to this form are copies of the solicitation documentation in accordance with Section 6 (E) Bid Requirements of the Executive Order, used to solicit certified MWBEs for the subcontract opportunities accompanied with the signed MWBE Subcontractor Unavailability Certificate (Form D).

3. Bidder/Offeror made the following attempts to solicit MWBEs:

Signature – Bidder Offeror

Print or Type Name of Firm

Street Address

City State Zip Code

Date



JOHN A. OLSZEWSKI, JR.
County Executive

SEVETRA PEOPLES-BROWN
Executive Director
Chief of Diversity, Equity and Inclusion

To: Contractors/Consultants

From: Minority and Women Business Enterprise Office

Date: December 13, 2024

Subject: Compliance Reporting and Penalties

Baltimore County, Maryland (the "County") requires all Prime Contractors and all Subcontractors to submit payment reports by the 10th of each month through an online MWBE Compliance Portal (PRISM). The Portal can be found under Compliance Reporting for Primes and Subcontractors at www.baltimorecountymd.gov/go/mwbe. In the event you are not able to enter your payments in PRISM, a spreadsheet is attached for your use. Please be sure to list the PO for each invoice/ payment reported and include in your submission any corresponding documentation (e.g. copies of invoices or canceled checks).

The County has found that a number of companies are failing to file reports in a timely manner, which makes it difficult for the County to verify compliance. As a result, the County has determined to assess penalties for non-compliance, effective September 1, 2018, as follows:

- (a) For failure to file timely monthly reports:
 - a. Assessment of a late fee of \$10 per day per task, up to a maximum of \$1,500 per task; and/or
 - b. For multiple violations, termination of the contract for convenience or for default, with the contractor suspended from participating in County contracts for five (5) years.
- (b) For failure to meet MWBE requirements:
 - a. Assessment of a penalty of up to 10% of the contract value; and/or
 - b. Termination of the contract for convenience, with the contractor suspended from participating in County contracts for five (5) years together with assessment of a penalty of up to 10% of the contract value; and/or
 - c. Termination of the contract for default together with assessment of a penalty of 10% of the contract value.

Each action and/or remedy described above is at the sole discretion of the County, and is in addition to any damages which the County may be entitled to under the contract. This short video can be used as guidance on submitting the Prime to Subcontractor Payment Reporting:

http://stage.prismcompliance.com/etc/movies/vendor_contractpayment_tutorial.htm

If after contract expiration, it has been determined the MWBE firms named were not used or were under used, by the contractor and supporting documentation was not provided and approved by the County the contractor may be assessed a penalty of up to 10% of the contract value and/or suspended from participating in County contracts for 5 years.

Questions regarding this correspondence and/or the use of this system can be directed to the MWBE Office at mwbe@baltimorecountymd.gov or call (410) 887-3407.

Attachment: MWBE Payment Report Form
 MWBE Payment Acknowledgement Form

Cc: File

S E C T I O N V

POST AWARD DOCUMENTS

**This Section to be Completed
by Successful Bidder after Award**

C O N T R A C T A G R E E M E N T

THIS CONTRACT AGREEMENT (“Contract”), IS MADE THIS _____ day of _____ 20____, by and between Baltimore County, Maryland, a body corporate and politic (“County”), and _____, (“Contractor”).

WITNESSETH, that the Contractor, for and in consideration of the payment or payments herein specified and agreed to by the County, hereby covenants and agrees to furnish and deliver all the materials and to do and perform all the work, services, and labor in fulfillment of the requirements of Contract Number **25054 GX0** “Project”) in strict conformity with the solicitation, plans, specifications, special provisions, any and all addenda, and the proposal, at the prices named therein, and all of which are collectively the Proposal, and said Proposal is attached hereto and made a part thereof.

The Project shall be done in strict compliance with (i) the Proposal, (ii) the Baltimore County Department of Public Works and Transportation September 2023 “Standard Specifications for Construction and Materials” and “Standard Details for Construction” (iii) and any and all revisions thereto as of the date of advertisement, including but not limited to the General Conditions Building Projects, as applicable, and all of which (i-iii) are made a part hereof and incorporated herein (collectively, the “Specifications”). Contractor understands and agrees it is Contractor’s responsibility and obligation to obtain a copy of the “Specifications” and agrees the Specifications are incorporated herein. Copies are available on the County’s website at www.baltimorecountymd.gov/departments/public-works/standards.

The Project shall be subject to the inspection and approval of the Office of Budget and Finance – Property Management for Baltimore County, or his authorized representative, and in the event any portion thereof shall be rejected by said Director or his representative as defective or unsuitable, then the said portion shall be removed and replaced and be performed anew to the satisfaction and approval of the said Director or his representative at the cost and expense of the Contractor.

THE CONTRACTOR AFFIRMS that it is aware of, and will comply with, the provisions of Sections 14-101 through 14-108 of the Election Law Article of the Annotated Code of Maryland, as the same may be amended from time to time, which require that every person who makes, during any 12-month period, one or more contracts, with one or more Maryland governmental entities involving cumulative consideration, of at least \$200,000.00, to file with the State Board of Elections certain specified information to include disclosure of attributable political contributions in excess of \$500 during defined reporting periods.

THE CONTRACTOR FURTHER COVENANTS AND AGREES that all the Project shall be furnished, performed and delivered, in every respect, to the satisfaction and approval of the Office of Budget and Finance – Property Management, aforesaid, on or before the expiration of **Three Hundred (300) CALENDAR DAYS** (the “Contract Period”) after written notice has been given by the Director or their authorized representative to begin the work.

IT IS AGREED THAT TIME IS OF THE ESSENCE. In the event the Contractor fails to achieve Final Completion and Final Acceptance of the Contract work within the Contract Period specified herein, plus any extensions thereto agreed to in writing by a legally authorized representative of the County pursuant to the terms of this Contract, then Contractor shall pay the County the sum of **FIFTEEN HUNDRED DOLLARS (\$1500.00)** as Liquidated Damages for each **CALENDAR DAY** after the expiration of the Contract Period, as may be extended by the County, until the Contractor achieves Final Completion and Final Acceptance of the Project.

Contractor’s Initials

Date

Rev. 09/2024

IT IS FURTHER AGREED that:

- (a) These Liquidated Damages are a reasonable estimate of the County's damages solely due to the public's loss of use of the Project during the delay period and is not a penalty.
- (b) It is very difficult, if not impossible, to accurately measure the damages to the County due to the public's loss of use of the Project during the delay period.
- (c) Notwithstanding GP 8.09 of the Baltimore County Standard Specification for Construction, in addition to the damages due to the public's loss of use of the Project during the delay period, the County is likely to incur additional direct costs during the delay period, including but not limited to, costs for construction management, consultants, architectural services, office trailer and supplies, utilities, County employees' time, County vehicles, and such other costs that the County will incur to continue administration of the construction and the Contract during the delay period, all of which will be monitored by the County, and if so required by the County, the Contractor shall pay such actual damages incurred during the delay period. THE PARTIES HERETO UNDERSTAND AND AGREE THAT CONTRACTOR'S OBLIGATION TO PAY THE COUNTY FOR ACTUAL DAMAGES DURING THE DELAY PERIOD SHALL BE IN ADDITION TO THE CONTRACTOR'S OBLIGATION TO PAY THE LIQUIDATED DAMAGES DUE TO THE PUBLIC'S LOSS OF USE OF THE PROJECT.
- (d) The County shall have the right, but not the obligation, to deduct the Liquidated Damages due to the public's loss of use of the Project, and the County's actual costs and costs to continue administration of the construction and the Contract, from any monies due or any monies that may become due to the Contractor.

IT IS DISTINCTLY UNDERSTOOD AND AGREED that no claim for extra work, material or overhead not specifically provided for in the Contract will be allowed by the County, nor shall the Contractor do any work or furnish any materials not covered by this Contract and the Specifications, unless the same is ordered in writing by a legally authorized representative of the Office of Budget and Finance – Property Management in accordance with the terms of the Contract. Any such work or materials which may be done or furnished by the Contractor without any such written order first being given shall be at said Contractor's sole risk, cost and expense and Contractor hereby covenants and agrees that without such written order, Contractor shall make no claim for compensation for work, materials, or overhead so done or furnished.

NOTWITHSTANDING GP 4.06 OF THE BALTIMORE COUNTY STANDARD SPECIFICATIONS FOR CONSTRUCTION, IT IS SPECIFICALLY AGREED that the Contractor shall have no entitlement to damages arising out of delay, disruption, interference or hindrance from any cause whatsoever. However, this provision shall not preclude recovery or damages by the Contractor for hindrances or delays due solely to fraud or gross negligence on the part of the County or its agents.

IT IS FURTHER DISTINCTLY AGREED that the said Contractor shall not assign this Contract, nor any part thereof, nor any right to any of the monies to be paid hereunder, nor shall any part of the work to be done or material furnished under said Contract be sublet without the prior written consent of a legally authorized representative of the Office of Budget and Finance – Property Management in accordance with the terms of this Contract. Further, the acceptance of the final payment by the Contractor shall effectuate a release in full of all claims against County and its officials, employees, representatives, and agents arising out of, or by reason of the Project and this Contract.

The Contractor shall review government issued identification and badge all employees of the Contractor and its subcontractors. The Contractor shall also review all federal forms, including but not limited to I-9's, for compliance as well as copies of all employment eligibility and identity documentation maintained to the extent required by law.

The Bonds, given by the Contractor in a sum equal to the total contract price of the Project in compliance with the terms and provisions of this Contract, are hereby attached and incorporated herein.

IT IS AGREED that in the event that the County is delayed or prevented from timely execution of this Contract, the Contractor releases County and agrees Contractor shall have no action, claim or demand against County therefore.

Contractor's Initials

Date

Rev. 09/2024

THE CONTRACTOR HEREBY FURTHER AGREES to receive the prices set forth in the Proposal incorporated herein as full compensation for the completion of the Project and, in all respects, to complete said Contract to the satisfaction of the County.

THE CONTRACTOR REPRESENTS AND WARRANTS:

- (i) it is duly formed and validly existing under the laws of the State of _____;
- (ii) it is in good standing in the State of Maryland;
- (iii) it has the power and authority to consummate the obligations and responsibilities contemplated hereby, and has taken all necessary action to authorize the execution, delivery and performance required under this Contract;
- (iv) the Contractor and the person executing this Contract for the Contractor each warrant that he/she is duly authorized by the Contractor to execute and seal this Contract on the Contractor's behalf;
- (v) the warranties of merchantability and fitness for a particular purpose and use and warranties of title and against infringement, and all express warranties contained in this Contract, including but not limited to the Proposal (and any sample or model presented by Contractor and expressly accepted by the County) shall apply to the portion of this Contract pertaining to or for goods;
- (vi) all representations and warranties made in the Proposal and herein remain true and correct in all respects when made, as of the date of this Contract, and throughout the term of this Contract; and
- (vii) there exists no actual or potential conflict of interest between its performance under this Contract and its engagement or involvement in any other personal or professional activities and in the event such conflict or potential conflict arises during the term of this Contract, the Contractor shall immediately advise the County in writing thereof.

THE CONTRACTOR shall not disclose any documentation and information of any kind or nature disclosed to the Contractor in the course of its performance of duties hereunder without the express prior written consent of the County.

Those sections in this Contract which by their nature are intended to survive, including but not limited to, Contractor's representations and warranties, confidential information, and indemnification shall survive the termination of this Contract.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand and seal the day and year first above written.

CONTRACTOR NAME: _____

WITNESS FEDERAL TAX ID or SS #: _____

By: _____ (Seal)

Name: _____

Type (Print) Name

Title: _____ Date: _____

WITNESS: **BALTIMORE COUNTY, MARYLAND**

Executive Secretary By: _____ Date: _____
D'Andrea L. Walker, County Administrative Officer

Type (Print) Name

APPROVED FOR FORM AND LEGAL
AND SUFFICIENCY* (Subject to
execution by the duly authorized
Administrative official and Chairperson
of the County Council, as indicated).

APPROVED:

Kevin D. Reed, Director
Office of Budget and Finance Date: _____

Office of the County Attorney

*Approval of Form and Legal Sufficiency does not convey approval or disapproval of the substantive nature of this transaction. Approval is based upon typeset documents. All modifications require re-approval.

Rev. 09/2024

PERFORMANCE BOND

Bond No. _____

Principal _____

Business Address of Principal _____

Surety _____

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

Penal Sum of Bond (express in words and figures)

Holt Memorial Park Enhancements

Contract Name

25054 GX0

Contract Number

DOLLARS

\$

20

Date of Contract

20

Date Bond Executed

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL, above-named, and SURETY, above-named, and authorized to do business in the State of Maryland, are held and firmly bound unto the OBLIGEE, above-named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE PRINCIPAL entered into a certain contract with the OBLIGEE described and dated as shown above and is required to provide this bond pursuant to Maryland State law and/or County law and the contract.

NOW, THEREFORE, if the aforesaid PRINCIPAL shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the OBLIGEE with or without notice to the SURETY, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the SURETY being hereby waived, then, this obligation to be void; otherwise to remain in full force and effect.

THE SURETY FURTHER GUARANTEES That it is (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. A Performance Bond is required for each and every Contract in excess of twenty-five thousand (\$25,000). A Performance Bond shall be in the amount equal to at least one hundred (100%) percent of the Contract price. The fully executed Performance Bond shall be delivered by the Bidder to the Department's Division of Construction Contracts Administration no later than the time the Contract is to be executed by the Contractor.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and seal of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:**Individual Principal**

Witness: _____

as to: _____ (SEAL)

Print Name: _____

Print Name: _____

Attest:**Corporate Principal**

(Name of Corporation)

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Attest:**Surety**

(Name of Surety)

Business Address: _____

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Reviewed for Baltimore County Requirements

Office of the County Attorney

PAYMENT BOND

Bond Number _____

Principal _____

Business Address of Principal _____

Surety _____

Obligee: **BALTIMORE COUNTY, MARYLAND**
A body corporate and politic

A Corporation of the State of _____ and authorized to do business in Maryland

DOLLARS \$ _____

Penal Sum of Bond (express in words and figures) _____

Holt Memorial Park Enhancements
Contract Name_____ 20 _____
Date of Contract25054 GX0
Contract Number_____ 20 _____
Date Bond Executed

KNOW ALL MEN BY THESE PRESENTS, that we, the PRINCIPAL, above-named, and SURETY, above-named, and authorized to do business in the State of Maryland, are held and firmly bound unto the OBLIGEE, above-named, in the penal sum of the amount stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, THE PRINCIPAL entered into a certain contract with the OBLIGEE described and dated as shown above and is required to provide this bond pursuant to Maryland State law and/or County Law and the contract.

NOW, THEREFORE, the condition of this obligation is such that if the aforesaid PRINCIPAL shall promptly make payments to all persons supplying labor and/or material to the PRINCIPAL and to any subcontractor of the PRINCIPAL in the prosecution of the work provided for in said contract and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the SURETY being hereby waived, then, this obligation to be void; otherwise to remain in full force and effect.

THE SURETY FURTHER GUARANTEES That it is (a) licensed in the State of Maryland, (b) rated "B" or better by the A.M. Best Company, (c) on federal funded projects, authorized by the underwriting limitation contained in the U.S. Department of the Treasury Circular 570, as amended, to guaranty the amount of the Bid, and (d) in good standing as determined by the County's Engineer. A Payment Bond is required for each and every Contract in excess of twenty-five thousand (\$25,000). A Payment Bond shall be in the amount equal to at least one hundred (100%) percent of the Contract price. The fully executed Payment Bond shall be delivered by the Bidder to the Department's Division of Construction Contracts Administration no later than the time the Contract is to be executed by the Contractor.

IN WITNESS WHEREOF, the above-bounded parties have executed this instrument under their several seals on the date indicated above, the name and seal of each party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In Presence of:

Individual Principal

Witness: _____

as to: _____ (SEAL)

Print Name: _____

Print Name: _____

Attest:

Corporate Principal

(Name of Corporation)

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Attest:

Surety

(Name of Surety)

Business Address: _____

Witness: _____

By: _____ Affix

Print Name: _____

Print Name: _____ Corporate

Title: _____ Seal

Reviewed for Baltimore County Requirements

Office of the County Attorney



BALTIMORE COUNTY, MARYLAND

INSURANCE PROVISIONS

1. GENERAL REQUIREMENTS

- 1.1 Coverages Required:
Unless otherwise required by the specifications or the contract, the Contractor/Vendor shall purchase and maintain the insurance coverage's listed herein.
- 1.2 Certificate of Insurance:
Before starting work on the contract, or prior to the execution of the Contract on those bid, the Contractor/Vendor shall provide Baltimore County, Maryland with verification of insurance coverage evidencing the required coverages.
- 1.3 Baltimore County as Insured:
The coverage required, excluding Workers' Compensation and Employers' Liability and Medical Malpractice Liability/Professional Liability/Errors and Omissions Liability, must include Baltimore County, Maryland and its agents, employees, officers, directors, and appointed and elected officials as an additional insured.
- 1.4 Contractor's/Vendor's Responsibility:
The providing of any insurance herein does not relieve the Contractor/Vendor of any of the responsibilities or obligations the Contractor/Vendor has assumed in the contract or for which the Contractor/Vendor may be liable by law or otherwise.
- 1.5 Failure to Provide Insurance:
Failure to provide and continue in force the required insurance shall be deemed a material breach of the contract. The Contractor/Vendor must maintain the insurance coverages required under the terms and conditions on this Contract while this Contract is in effect including renewal and extension terms.

2. INSURANCE COVERAGES

- 2.1 General Liability Insurance
- 2.1.1 Minimum Limits of Coverage:
Personal Injury Liability and Property Damage Liability
Combined Single Limit - \$500,000 each occurrence.
- 2.1.2 Such insurance shall protect the Contractor/Vendor from claims which may arise out of, or result from, the Contractor's/Vendor's operations under the contract, whether such operations be by the Contractor/Vendor, any subcontractor, anyone directly or indirectly employed by the Contractor/Vendor or Subcontractor, or anyone for whose acts any of the above may be liable.
- 2.1.3 Minimum Coverages to be Included:
(a) Independent Contractor's coverage;
(b) Completed Operations and Products Liability coverage;
(c) Contractual Liability coverage.

- 2.1.4 Damages not to be Excluded:
Such insurance shall contain no exclusions applying to operations by the Contractor/Vendor or any Subcontractor in the performance of the Contract including but not limited to:
(a) Collapse of, or structural injury to, any building or structure;
(b) Damage to underground property; or
(c) Damage arising out of blasting or explosion.

2.2 Automobile Liability Insurance

- 2.2.1 Minimum Limits of Coverage:
Bodily Injury Liability and Property Damage Liability
Combined Single Limit - \$500,000 any one accident.
- 2.2.2 Minimum Coverages to be Included:
Such insurance shall provide coverage for all owned, non-owned and hired automobiles.

2.3 Workers' Compensation and Employers' Liability Insurance

Such insurance must contain statutory coverage, including
Employers' Liability insurance with limits of at least:
Bodily Injury by Accident - \$250,000 each accident
Bodily Injury by Disease - \$500,000 policy limit
Bodily Injury by Disease - \$250,000 each employee

2.4 Valuable Papers and Records Coverage and Electronic Data Processing (Data and Media) Coverage

Minimum Limits of Coverage:
\$100,000 Per Claim and Each Occurrence
\$100,000 in the Aggregate

2.5 Other

Such other insurance in form and amount as may be customary for the type of business being under taken by the Contractor/Vendor.

2.6 Builder's Risk

See Special Provisions page 868 and General Conditions page 34,35, Article 33.